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## THE EFFECT OF FRESH AND FROZEN PRE-FERMENTED JUICE ON THE FERMENTATION QUALITY OF FIRST-CUT LUCERNE SILAGE

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**Key words:** previously fermented juice, lucerne silage, fermentation quality digestibility.

### SUMMARY

This study was carried out to exam the possible effect of fresh and frozen pre-fermented juice (PFJ) on the fermentation quality and nutritive value parameters of first-cut lucerne (*Medicago sativa L.*) silage. Barley (B), wheat (W) and grass herbage (G) were used to prepare the PFJs. Both fresh (PFJ-B, PFJ-W and PFJ-G) and frozen (PFJ-B<sub>F</sub>, PFJ-W<sub>F</sub> and PFJ-G<sub>F</sub>) PFJs were investigated. Frozen PFJs were prepared by freezing fresh PFJs at -22°C with 20% glycerol (v/v). Treatments of lucerne silage consist of (1) control; (2) silage treated with PFJ-B; (3) silage treated with PFJ-W; (4) silage treated with PFJ-G; (5) silage treated with PFJ-B<sub>F</sub>; (6) silage treated with PFJ-W<sub>F</sub> and (7) silage treated with PFJ-G<sub>F</sub>. Each treatment had five replicate silos and replicates were prepared in 1.0 L glass bottle laboratory silos. Silages treated with fresh and frozen PFJs, regardless of plant material, had better fermentation quality than the control silage in terms of lower pH, butyric acid (BA) and ammonia nitrogen (NH<sub>3</sub>-N) concentrations. Additionally, treated silages with fresh PFJs had higher lactic acid (LA) concentration ( $P < 0.05$ ) and *in vitro* organic matter digestibility (IVOMD) and metabolizable energy (ME) values ( $P < 0.05$ ) than control silage. According to results of this study, fresh PFJ treatments not only enhanced the nutritive value and fermentation quality but also increased IVOMD and ME content of first-cut lucerne silage.

Legumes are difficult to ensile successfully without an additive because of their low sugar content and high buffering capacity (McDonald *et al.*, 1991). This is especially true of lucerne (*Medicago sativa L.*). Various additives, such as bacterial inoculants, acidifiers, formaldehyde and tannic acid have been developed to improve the ensiling properties of lucerne silage (Santos *et al.*, 2000) but reports of their efficacy are inconsistent. Previous studies suggested that the inoculation with lactic acid bacteria (LAB) at ensiling could improve the fermentation of legume silage by accelerating the production of lactic acid (LA) to cause acidic conditions to occur as rapidly as possible (Tengerdy *et al.*, 1991). Recently, it has been demonstrated that silage lactic acid concentration and fermentation quality were improved in all cases in which pre-fermented juices (PFJs) were added to the ensilage of lucerne (Denek *et al.*, 2011; Wang *et al.*, 2009). Ohshima *et al.* (1997a,b,c) reported that the PFJ can often increase lactic acid concentration and decrease NH<sub>3</sub>-N concentration in lucerne silage even when the addition of commercial LAB was ineffective. Pre-fermented juice was prepared by culturing microorganism adherent to the lucerne materials before ensiling silage material and the grown microorganisms were used as a starter of silage fermentation. Ohshima *et al.* (1997b) suggested that the PFJ preparation material made from the same silage crop might be more efficient for improving the quality of silage than those made from other crops. In contrast, Denek *et al.* (2011) reported that silage treated with fresh and frozen

molasses-based PFJs, regardless of plant material, had better fermentation quality than control silage in terms of lower pH, butyric acid and ammonia nitrogen concentrations, as well as higher lactic acid concentration and *in vitro* organic matter digestibility. PFJ materials other than lucerne herbage might not be always available for preparing PFJ when the ensiling lucerne. In these cases, Denek *et al.* (2011) suggested that formerly prepared and frozen molasses based PFJ can be used as an inoculum source. Therefore, this study was designed to evaluate the possible effect of fresh and frozen sucrose-based PFJs on the fermentation quality and *in vitro* organic matter digestibility values of first-cut lucerne silage.

## 1. MATERIAL AND METHOD

### Preparation of PFJs

The PFJs were prepared using barley (B; *Hordeum vulgare*), wheat (W; *Triticum durum*) and grass herbage (G; *Bromus inermis*) harvested at the flag emerges; at least 3 nodes were visible above the soil surface from similar fields for PFJ herbage sources. These plant materials were harvested at 26 and 31 March 2010. PFJ was prepared according to the method described by Masuko *et al.* (2002). For this purpose, 200 g plant material was macerated with 1000 mL distilled water and 2 min in a high-speed blender. The macerate was filtered through two layers of cheesecloth and aliquots of filtrate were collected in glass bottles to which sucrose was added at 3 g per 100 mL (w/v) filtrate. These bottles were fitted with a gas trap and kept in an incubator for 48 h at 30°C. After precipitation, the supernatant brown liquor (i.e., PFJ) was collected and considered as PFJ. PFJ-B, PFJ-W and PFJ-G were used as the fresh inoculant source; PFJ-B<sub>F</sub>, PFJ-W<sub>F</sub> and PFJ-G<sub>F</sub> were also used as the frozen inoculant source. Frozen PFJs were prepared by freezing PFJs at -22°C with 20% glycerol (v/v) one week (2 days incubation and 5 days frozen), while fresh PFJs prepared 2 days before ensiling. The number of LAB (colony-forming units, CFU, mL<sup>-1</sup>) in the PFJs was counted by using GYP-CaCO<sub>3</sub> agar plates (Masuko *et al.*, 1992) which were incubated for 5 days at 35°C.

### Silage Preparation and Treatments

First-cut of lucerne (*Medicago sativa L.*), at 280 g kg<sup>-1</sup> dry matter (DM) content of fresh material, was used as silage material and harvested at the early bloom stage with standard field equipment (mower-conditioner, forage harvester) from private farm near the Harran University at 2 April 2010. The chopped lucerne (1-3 cm) was weighed, sprayed with the appropriate PFJ solution (or water for the control) with a plant sprayer (one sprayer for each treatment), mixed by hand and then placed into the 1.0 L anaerobic glass bottle laboratory silos by hand compressing to a final density of 600 g L<sup>-1</sup>. Disposable gloves were used for harvesting and handling then changing gloves after each treatment to prevent cross-contamination. The PFJs and water were applied at a rate of 5 mL kg<sup>-1</sup> (v/w) fresh material. Experimental silage treatments consisted of five replicates for each treatment including (1) control; (2) silage treated with PFJ-B; (3) silage treated with PFJ-W; (4) silage treated with PFJ-G; (5) silage treated with PFJ-B<sub>F</sub>; (6) silage treated with PFJ-W<sub>F</sub> and (7) silage treated with PFJ-G<sub>F</sub>. The silos were stored for 45 days at room temperature (~22 °C).

### Analytical Procedures

Glass bottle laboratory silos were opened after 45 days of ensiling. The pH values and dry matter contents of the silages were immediately measured. Dry matter contents of the silages were determined by drying 20 g of the ensiled forage at 105°C for 24 h in a forced-air oven. The pH values of the silages were measured with a laboratory pH meter (Orion, Thermo Electron Corp., Kent, WA, USA). After pH determined, 10 ml filtrate was acidified with 0.1 ml 1 M HCl (v/v) and stored at -22°C for NH<sub>3</sub>-N analysis. The NH<sub>3</sub>-N content was analyzed according to Broderick and Kang (1980) by the Kjeldahl method. Volatile fatty acids (VFA) were determined by gas chromatography with Hewlett Packard-6890 equipment. Lactic acid was determined by *high-performance liquid chromatography* (HPLC).

Dry matter contents of the silages were determined by drying 20 g of the ensiled forage at 60°C for 48–72 h in a forced-air oven and then weighing them. After weighing, the dried sample was ground through 1- mm screen in a Wiley mill and analyzed for crude protein (CP) content by the AOAC (1990) method. Neutral detergent fiber (NDF) and acid detergent fiber (ADF) content was analyzed according to methods described by Van Soest *et al.* (1991).

The IVOMD values of the silage were determined through the method described by Menke *et al.* (1988). The IVOMD (g kg<sup>-1</sup> OM) and ME (MJ kg<sup>-1</sup> DM) of silages were calculated using equations reported by Menke *et al.* (1979). The Flieg score was calculated based on the pH values and DM content of the silages by using the equation given by Flieg (1938).

### Statistical Analysis

The data were analyzed by one-factor ANOVA using the general linear models procedure of SAS (1989). Differences among means were determined by Tukey's multiple comparison tests at a significance level of  $P < 0.05$  (Steel and Torrie, 1980).

## 2. RESULTS AND DISCUSSIONS

The pH and LAB counts of the PFJs are shown in Table 1. The pH values of the PFJs ranged from 3.67-3.97 and the LAB counts ranged from  $8.0 \times 10^7$ -  $1.9 \times 10^9$  CFU mL<sup>-1</sup>. The lowest pH (3.67) value and the highest LAB count ( $1.9 \times 10^9$  CFU mL<sup>-1</sup>) were obtained from PFJ-G.

The effects of PFJs treatments on chemical composition, IVOMD and ME values of lucerne silages are presented in Table 2. There were no significant differences in CP content among the control and other silages treated with PFJs. The control silage had a higher NDF (400 g kg<sup>-1</sup> DM) and ADF (344 g kg<sup>-1</sup> DM) contents compared to the silages treated with PFJs ( $P < 0.05$ ) only exception of PFJ-G. The control silage had lower IVOMD and ME values compared to the silages treated with PFJ-(B;W;G) ( $P < 0.05$ ) but not with frozen PFJs ( $P > 0.05$ ). The IVOMD of silages ranged from 581 to 620 g kg<sup>-1</sup> OM and the highest IVOMD was obtained from the silages treated with PFJ-B. The ME values of silages ranged from 10.0 to 10.5 MJ kg<sup>-1</sup> DM and ME values of the silage treated with PFJs were higher than control silage ( $P < 0.05$ ) with exception of PFJ-W<sub>F</sub> ( $P > 0.05$ ). The DM content and CP concentration were higher and the NDF and ADF

concentrations were lower than the previously reported values of first-cut lucerne silage (Cao *et al.*, 2002; Wang *et al.*, 2009). The control silage had lower IVOMD compared with the silages treated with PFJs ( $P < 0.05$ ). This result was supported by some researchers (Denek *et al.*, 2011; Nishino and Uchida, 1999; Wang *et al.*, 2009) who reported that PFJ treatments increased the IVOMD of silages. Cao *et al.* (2002) reported that the addition of PFJ to lucerne improved the apparent digestibility of dry and organic matter in cows that were fed lucerne silage. Many factors such as the type and properties of the plants to be ensiled, climatic conditions, epiphytic microflora, ensiling technique and the properties of the inoculant affect the success of silage inoculants (Henderson and McDonald, 1984). Legume crops have a high buffering capacity, thus it is difficult to ensile. Weinberg *et al.* (1988) indicated that usage of LAB improved fermentation patterns in the legume silages helped to reduce DM losses and repressed undesirable microorganisms. In the current study, all PFJ treatments showed significantly positive effects on the fermentation quality of the first-cut lucerne silage.

Table 1

Composition of pre-fermented juices (PFJs)			
PFJs	Origin	pH	LAB (cfu/mL <sup>-1</sup> )
PFJ-B	Fresh PFJ, prepared with Barley herbage	3.69	1.4x10 <sup>9</sup>
PFJ-W	Fresh PFJ, prepared with Wheat herbage	3.71	1.5x10 <sup>9</sup>
PFJ-G	Fresh PFJ, prepared with Grass herbage	3.67	1.9x10 <sup>9</sup>
PFJ-B <sub>F</sub>	Frozen PFJ, prepared with Barley herbage	3.97	8.0x10 <sup>7</sup>
PFJ-W <sub>F</sub>	Frozen PFJ, prepared with Wheat herbage	3.85	2.9x10 <sup>8</sup>
PFJ-G <sub>F</sub>	Frozen PFJ, prepared with Grass herbage	3.89	3.0x10 <sup>8</sup>

The effects of the PFJ treatments on fermentation characteristics of lucerne silages are presented in Table 3. The PFJ treatments significantly decreased the pH values of the silages compared to the control ( $P < 0.05$ ). The pH values of silages ranged from 4.37 to 5.87 and highest pH value (5.87) obtained from control silage. The Fleig score of the control silage (20.7) was lower than the silages treated with PFJs ( $P < 0.05$ ). In addition, there was an increase in LA levels and a decrease in NH<sub>3</sub>-N levels of the silages treated with PFJs. Propionic acid (PA) was not detected in any of the silage treatments; on the other hand, butyric acid (BA) was only detected in control silages. Comparison of fresh and frozen PFJs was in consisted overall fermentation quality parameters.

Silage pH is one of the main factors that influence the extent of fermentation and silage quality of ensiled forage. The contribution of PFJ is to increase the concentration of LA to provide an acid condition as rapidly as possible (Ohshima *et al.*, 1997b). There was an abundance of microorganisms in the PFJ before it was sprayed on to the lucerne herbage.

Table 2

**Effect of pre-fermented juice (PFJ) treatments on chemical composition, IVOMD and ME values of lucerne silages**

	DM	CP	NDF	ADF	IVOMD	ME
<b>Fresh Lucerne herbage#</b>	<b>280</b>	<b>212</b>	<b>453</b>	<b>353</b>	<b>608</b>	<b>10.2</b>
<b>Treatments##</b>						
Control	252 <sup>d</sup>	231 <sup>ab</sup>	400 <sup>a</sup>	344 <sup>a</sup>	581 <sup>c</sup>	10.0 <sup>b</sup>
PFJ-B	269 <sup>a</sup>	236 <sup>a</sup>	348 <sup>c</sup>	319 <sup>b</sup>	620 <sup>a</sup>	10.5 <sup>a</sup>
PFJ-W	266 <sup>abc</sup>	236 <sup>a</sup>	382 <sup>b</sup>	320 <sup>b</sup>	617 <sup>a</sup>	10.4 <sup>a</sup>
PFJ-G	258 <sup>bcd</sup>	234 <sup>ab</sup>	383 <sup>b</sup>	335 <sup>a</sup>	610 <sup>ab</sup>	10.4 <sup>a</sup>
PFJ-B <sub>F</sub>	257 <sup>cd</sup>	229 <sup>ab</sup>	349 <sup>c</sup>	313 <sup>b</sup>	603 <sup>abc</sup>	10.4 <sup>a</sup>
PFJ-W <sub>F</sub>	269 <sup>a</sup>	227 <sup>b</sup>	350 <sup>c</sup>	296 <sup>c</sup>	593 <sup>bc</sup>	10.2 <sup>ab</sup>
PFJ-G <sub>F</sub>	266 <sup>ab</sup>	233 <sup>ab</sup>	352 <sup>c</sup>	309 <sup>bc</sup>	607 <sup>ab</sup>	10.5 <sup>a</sup>
SEM	0.13	0.89	0.35	0.28	0.2775	0.04
Level of Significance	*	*	*	*	*	*

#: Fresh lucerne herbage was not compared. ##:PFJ-B: Fresh PFJ, prepared with Barley herbage; PFJ-W: Fresh PFJ, prepared with Wheat herbage; PFJ-G: Fresh PFJ, prepared with Grass herbage; PFJ-B<sub>F</sub>: Frozen PFJ, prepared with Barley herbage; PFJ-W<sub>F</sub>: Frozen PFJ, prepared with Wheat herbage; PFJ-G<sub>F</sub>: Frozen PFJ, prepared with Grass herbage.

<sup>a,b,c</sup>: For each column, mean values with different letters are significant at P<0.05.

NS: non-significant, DM: dry matter, (g kg<sup>-1</sup>); CP: crude protein, (g kg<sup>-1</sup> DM); NDF: Neutral detergent fibre, (g kg<sup>-1</sup> DM), ADF: acid detergent fibre, (g kg<sup>-1</sup> DM), IVOMD: *in vitro* organic matter digestibility, (g kg<sup>-1</sup> OM); ME: metabolizable energy, (MJ kg<sup>-1</sup> DM).

The mode of action of PFJ was likely similar to the lactic acid bacteria additives by providing large amounts of lactic acid bacteria to accelerate production of lactic acid and the resultant decline of pH (Wang *et al.*, 2009). However, PFJ benefits occurred in this study such that silage treated with PFJ had lower pH and NH<sub>3</sub>-N content and higher lactic acid concentrations. The PFJ treatments significantly improved the silage quality by the lowering pH values (4.37-4.63 versus 5.87), NH<sub>3</sub>-N concentrations (23.0-39.9 versus 52.6 g kg<sup>-1</sup> of total nitrogen, TN) and the higher concentrations of LA (53.2-75.1 versus 33.0 g kg<sup>-1</sup> DM). NH<sub>3</sub>-N content of less than 45 g kg<sup>-1</sup> or 11% of TN has been identified as characteristic of well-preserved silage (Carpintero *et al.*, 1969). In the current study, the NH<sub>3</sub>-N content of the silages treated with PFJs (23.0-39.9 g kg<sup>-1</sup> TN) was lower than that of the control (52.6 g kg<sup>-1</sup> TN). This indicated that the higher concentration of LA and lower pH values in the silages treated with PFJs than in the control can be explained due to inhibiting the activity of proteolysis by plant enzymes and other undesired bacterial activity during the early stage of ensiling. Butyric acid was only detected in the control silage, which indicates that some clostridial bacterial activity had occurred in control silage (Weinberg *et al.*, 1988). This can be result of the low WSC amount of the initial lucerne, which resulted in insufficient production of LA and pH decline; thus, it increases the activity of clostridial bacteria during ensiling. The beneficial effect of PFJs observed in the current study and our previous study (Denek *et al.*, 2011) is because the PFJs probably caused intensive LAB fermentation. This could be linked to the LAB

content of PFJs. In the current study, acetic acid values of PFJ-B, PFJ-W, PFJ-G and PFJ-G<sub>F</sub> were higher than the control, PFJ-B<sub>F</sub> and PFJ-W<sub>F</sub> silages. Acetic acid found in the various silages serves as an antimycotic agent (Moon, 1983), thus presence of acetic acid might be advantageous for improving silage quality in this study.

Table 3

**Effect of pre-fermented juice (PFJ) treatments on fermentation characteristics of lucerne silages**

Treatments <sup>#</sup>			NH <sub>3</sub> -N	LA	AA	PA	BA
	pH	Fleig Score	(g/kg <sup>-1</sup> TN)	(g/kg <sup>-1</sup> DM)			
Control	5.87 <sup>a</sup>	20.7 <sup>c</sup>	52.6 <sup>a</sup>	33.0 <sup>d</sup>	12.4 <sup>d</sup>	ND	18.8
PFJ-B	4.45 <sup>d</sup>	80.7 <sup>ab</sup>	25.8 <sup>cd</sup>	71.5 <sup>a</sup>	17.1 <sup>c</sup>	ND	ND
PFJ-W	4.37 <sup>e</sup>	83.4 <sup>a</sup>	25.9 <sup>cd</sup>	75.1 <sup>a</sup>	22.7 <sup>b</sup>	ND	ND
PFJ-G	4.52 <sup>c</sup>	76.0 <sup>c</sup>	26.4 <sup>cd</sup>	56.0 <sup>c</sup>	33.7 <sup>a</sup>	ND	ND
PFJ-B <sub>F</sub>	4.63 <sup>b</sup>	71.4 <sup>d</sup>	39.9 <sup>b</sup>	53.2 <sup>c</sup>	13.0 <sup>d</sup>	ND	ND
PFJ-W <sub>F</sub>	4.48 <sup>cd</sup>	79.7 <sup>b</sup>	28.2 <sup>c</sup>	66.0 <sup>b</sup>	15.2 <sup>cd</sup>	ND	ND
PFJ-G <sub>F</sub>	4.48 <sup>cd</sup>	78.9 <sup>b</sup>	28.0 <sup>c</sup>	65.0 <sup>b</sup>	17.4 <sup>c</sup>	ND	ND
SEM	0.08	3.52	1.74	2.78	1.21	ND	ND
Level of Significance	*	*	*	*	*	-	-

<sup>#</sup>:PFJ-B: Fresh PFJ, prepared with Barley herbage; PFJ-W: Fresh PFJ, prepared with Wheat herbage; PFJ-G: Fresh PFJ, prepared with Grass herbage; PFJ-B<sub>F</sub>: Frozen PFJ, prepared with Barley herbage; PFJ-W<sub>F</sub>: Frozen PFJ, prepared with Wheat herbage; PFJ-G<sub>F</sub>: Frozen PFJ, prepared with Grass herbage.

<sup>a,b,c,d</sup> For each column, mean values with different letters are significant at P<0.05.

ND: not detected, NH<sub>3</sub>-N: Silage ammonia nitrogen content, LA: Silage lactic acid content, AA: Silage acetic acid content, PA: Silage propionic acid content, BA: Silage butyric acid content

### 3. CONCLUSIONS

The results in this study showed that the ensiling of first-cut lucerne by treating it with fresh or frozen PFJs increased silage fermentative quality and organic matter digestibility. It can be concluded that PFJs can be directly used as a good sources of LAB for first-cut lucerne silage and it might be comparable to conventional silage additives and commercial LAB inoculants as a fermentative promoter. According to our current and previous (Denek *et al.*, 2011) studies, molasses or sucrose can be used source of energy during preparation PFJ without causing any major effect of first-cut lucerne silage quality. More research is required to determine herbage type, herbage chemical composition and active population of desirable and undesirable microbes of herbage used for PFJ preparation to minimize inconsistent results in practice.

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## **EFFECTS OF DIFFERENT LEVELS OF BORON SUPPLEMENTATION TO DIET ON PERFORMANCE AND BORON MINERALIZATION IN SOME TISSUES OF BROILERS**

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**Key words:** Boron, broiler, mineralization, performance

### **SUMMARY**

The purpose of this study was to evaluate the effects of B supplementation to diets on performance and B mineralization in some tissues of broilers. One hundred and fifty, 1-d-old broiler chicks (Ross 308) were divided into 5 groups with 3 replicates consisting of 10 animals each in the experiment. Boric acid was used as the B source. The dietary treatments consisted of the supplementation of the basal diets with 0, 5, 10, 20 and 40 ppm B supplied from boric acid. Supplementation of B from boric acid did not effect performance traits (BWG, FI and FCR) during the experiment ( $P>0.05$ ). Supplementation of B from boric acid did not effect on carcass percentage, liver B concentration and bone ash. But supplemental B effected liver weight and bone B concentration ( $P<0.05$ ) at the end of trial. It is concluded that more research is needed to determine the effects of B supplementation on performance and other parameters in broilers.

Trace elements and their deficiencies or functions are of great importance in poultry nutrition. Boron (B) has been known as an essential element for higher plants since 1920's, but some studies have been focus on the possible role of B animal and human nutrition in recent years. Several studies have indicated that B is an important mineral for body weight, feed consumption, reduced mortality rate, normal cartilage and bone formation in broilers. Boron has been examined as a possible nutritional factor in calcium (Ca) metabolism and utilization and, thus, as a factor in the development and maintenance of normal bone (Nielsen 1992). Bone-breaking strength and bone ash are often used as criteria for assessing the values of various dietary supplements, cage designs and animal densities for preventing bone breakage. For this reason, The National Research Council (NRC 1984) suggested that trace mineral supplements to chemically defined diets should contain at least 2 ppm B, although the B requirement for the different categories of poultry has not been determined (Hunt 1989, Nielsen and Shuler 1992, Rossi et al 1993). Boron affects at least 26 enzymes involved in substrate metabolism, insulin release, oxidation and immune systems (Hunt, 1998). Plant tissues usually contain 30-50 ppm B DM, while animal tissues contain 5-6 ppm B DM. Legumes are good sources of B, while whole grains contain very little B, though grains are widely used in poultry rations (Mızrak et. al., 2010).

The purpose of this study was to evaluate the effects of B supplementation to diets on performance and B mineralization in some tissues of broilers.

**1. MATERIAL AND METHOD**

One hundred and fifty, 1-d-old broiler chicks (Ross 308) were divided into 5 groups with 3 replicates consisting of 10 animals each in the experiment. Feed and drinking water were available ad libitum. The experimental period lasted to the 42th day. Lighting was treated as a 23 hours/day. In the trial, chickens received basal diets (as shown Table 1). Boric acid was used as the B source. The dietary treatments consisted of the supplementation of the basal diets with 0, 5, 10, 20 and 40 ppm B supplied from boric acid.

Initial weights of the birds were recorded at the beginning of the study. Body weight (BW) and feed intake (FI) were measured weekly, for each pen, and then body weight gain (BWG) *per pen* was calculated. Feed conversion ratio (FCR) was also calculated weekly as kg of FI *per kg* of BWG. Mortality was recorded daily. On the last day of the trial, five birds of mixed sex in each replicate were slaughtered for determination of carcass characteristics and liver and bone samples were obtained to determine B concentrations. Tibia and liver B concentrations were determined by MarsXpress Technology Inside and atomic emission spectrophotometer (VISTA AX CCD Simultaneous ICP-AES).

*Table 1*

<b>Composition of experimental diets</b>		
<b>Ingredients, %</b>	<b>Starter diet (0-3 weeks)</b>	<b>Grower diet (4-6 weeks)</b>
Corn	47.70	56.50
Soybean meal (47.6 % CP) <sup>1</sup>	30.60	28.00
Sunflower meal (32.0 % CP) <sup>1</sup>	9.80	6.07
Vegetable oil (8800 ME kcal kg <sup>-1</sup> )	8.25	6.30
Limestone	1.26	1.36
Dicalcium phosphate	1.61	1.13
Salt	0.35	0.30
Premix <sup>2</sup>	0.25	0.25
DL-Methionine	0.18	0.09
<b>TOTAL</b>	<b>100.00</b>	<b>100.00</b>
<b>Calculated nutrients</b>		
CP, %	21.98	19.98
ME, kcal/kg <sup>-1</sup>	3202	3202
Ca, %	0.999	0.900
Non-Phytate P, %	0.449	0.350
L-Lysine, %	1.119	1.018
DL-Methionine	0.500	0.380
Methionine+Cystine	0.902	0.751

<sup>1</sup> Analyzed value

<sup>2</sup> Supplied per kg of diets, vitamin A, 15000, IU; vitamin K, 5.0 mg; vitamin B<sub>1</sub>, 3 mg; vitamin B<sub>2</sub>, 6 mg; vitamin B<sub>6</sub>, 5 mg; vitamin B<sub>12</sub>, 0.03 mg; niacin, 30 mg; D-biotin, 0.1 mg; calcium D- pantothenate, 12.0 mg; folic acid, 1.0 mg; choline chloride, 400 mg; manganese, 800 mg; iron, 35 mg; zinc, 50 mg; copper, 5.0 mg; iodine, 2 mg; cobalt, 0.04 mg; selenium, 0.15 mg.

Data obtained from the trial were analyzed by a one way analysis of variance for the level of supplemental B in the diet (Minitab Reference Manual, Release 10.1). Those response variables resulting in a significant F test were further analyzed using Duncan's multiple range test (Duncan 1955).

## 2. RESULTS AND DISCUSSIONS

Data on BWG, FI and FCR were shown in Table 2. Supplementation of B from boric acid did not effect performance traits (BWG, FI and FCR) during the experiment ( $P>0.05$ ). Supplementation of B from boric acid did not effect on carcass percentage, liver B concentration and bone ash. But supplemental B effected liver weight and bone B concentration ( $P<0.05$ ) at the end of trial. There were significantly differences between 2<sup>nd</sup> group and 1, 3, 4, and 5<sup>th</sup> groups for liver weights. Mean liver weights were significantly higher for broiler fed 5 ppm added B (2<sup>nd</sup>), when compared with the other groups. There were significantly differences between 1, 2 and 4th groups and 3 and 5<sup>th</sup> groups for bone B concentrations. Mean bone B concentrations were significantly higher for broiler fed 20 ppm added B (4<sup>th</sup>), when compared with the other groups.

Table 2

### Body weight gain, feed intake and feed conversion ratio of broiler chickens fed boron supplemented diets

Groups *	Body Weight Gain g			Feed Intake, G			Feed conversion ratio, FI, g/BWG, g		
	Weeks								
	0-3.	4-6.	0-6.	0-3.	4-6.	0-6.	0-3.	4-6.	0-6.
1	433.1	1348.	1781.	753.4	2997.	3751.	1.60	2.30	1.95
		1	3		9	3			
2	457.8	1471.	1929.	764.7	3177.	3942.	1.55	2.20	1.88
		2	0		5	2			
3	407.3	1264.	1671.	727.4	2655.	3382.	1.70	2.16	1.93
		1	0		0	0			
4	418.1	1170.	1588.	751.0	2607.	3358.	1.66	2.41	2.03
		0	1		5	6			
5	426.7	1318.	1745.	733.2	2743.	3476.	1.62	2.16	1.89
		6	3		4	6			
SEM	15.02	77.36	83.65	20.60	114.5	117.9	0.05	0.128	0.070
					5	5		8	

\* 1: control, 2: 5 mg/kg B, 3: 10 mg/kg B, 4: 20 mg/kg B, 5: 40 mg/kg B

Table 3

**Carcass yield, liver weight, some tissues B concentrations and bone ash of broiler chickens fed boron supplemented diets**

Groups*	Carcass yield, %	Liver weight, g	Boron, mg/kg		Bone Ash, %
			Bone	Liver	
1	72.0	41.0 <sup>b</sup>	1.93 <sup>d</sup>	2.29	38.6
2	70.5	62.0 <sup>a</sup>	2.24 <sup>c</sup>	2.36	38.8
3	67.0	45.0 <sup>b</sup>	2.40 <sup>b</sup>	2.54	41.1
4	71.5	31.0 <sup>b</sup>	2.56 <sup>a</sup>	2.44	41.3
5	70.0	34.5 <sup>b</sup>	2.41 <sup>b</sup>	2.47	41.8
SEM	1.22	4.57	0.352	0.059	2.39

\* 1: control, 2: 5 mg/kg B, 3: 10 mg/kg B, 4: 20 mg/kg B, 5: 40 mg/kg B

<sup>a, b</sup> Means with different minuscule in the same column are significantly different at  $P < 0.05$ .

Rossi *et al.* (1990) reported the effects of four B levels (0, 20, 80 and 320 ppm) combined with two levels of riboflavin (4.4 and 17.6 ppm) in the diets of broiler chickens from 1 to 49 days. At 21 days of age, feed intake, body weight and mortality were significantly lower for broilers given 320 ppm B in the diet. Besides, broilers fed diets containing B had better feed conversion in the experimental period when compared to the control group (0 ppm B). The three tested B levels had no effect on tibia weight and ash content. Elliot & Edwards (1992) evaluated different levels of B supplementation in the diet (0, 5, 10 and 20 ppm), as well as the possible interaction between B, calcium (0.65 and 0.90%) and cholecalciferol (110 and 1,100 ICU). Boron did not affect weight gain, feed efficiency or the incidence of tibial dyschondroplasia, but had a quadratic effect on bone ash (decreased ash % starting from 10 ppm). Boron requirements for broiler chickens in the first 21 days of age were evaluated in two trials with different supplementation levels: 0, 5, 40, 80 and 120 ppm in the first experiment and 0, 60, 120, 240 and 360 ppm in the second experiment (Rossi *et al.*, 1993). Supplementation with 5 ppm B resulted in a positive response; broilers were heavier and had more resistance to tibia breaking strength. On the other hand, broilers fed higher concentration of boron (360 ppm) in the second trial were lighter than those broilers given non-supplemented diet. Neither B levels in the liver nor broiler development were affected by diets containing more than 240 ppm B. Wilson & Ruszler (1997) studied the effects of boron supplementation in broiler diets and suggested that the addition of 50 ppm B improved some bone characteristics (resistance to breaking, shear force and ash percentage) but did not influence weight gain.

### 3. CONCLUSIONS

In this study, performance parameters were not influenced of B supplementation in broilers. The liver weights and bone B concentrations were affected by B

supplementation, however these effects were not observed clearly. It is concluded that more research is needed to determine the effects of B supplementation on performance and other parameters in broilers.

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## EFFECTS OF DIFFERENT SOURCES OF BORON SUPPLEMENTATION TO DIET ON EGG SHELL QUALITY AND BONE CHARACTERISTICS IN LAYING HENS

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**Key words:** Bone characteristics, boron sources, egg shell quality, laying hens

### SUMMARY

This study was conducted to determine the effect of different sources of boron supplementation to diet on egg shell quality and bone biomechanical characteristics in layer hens. At 44-wk-old 60 laying hens (Super Nick White) were fed to five dietary treatments during the 44-72 wk periods. Each treatment consisted of six replications of 12 hens (two hens per cage). Five treatments diets consisting of control and plus containing 300 mg/kg boron as boric acids, anhydrous borax, borax pentahydrate and borax decahydrate, respectively. During the experiment, feed and water were used as ad-libitum.

The different sources of boron supplementation did not significantly effect on egg shell quality parameters ( $P > 0.05$ ), except for egg shell thickness during the 60-64 weeks and egg shell strength during the 68-72 week in laying hens ( $P < 0.01$ ,  $P < 0.05$ ). Tibia shear stress and fracture energy significantly increased supplemental dietary B (300 mg/kg) from different sources in laying hens ( $P < 0.05$ ).

As a results of this study indicated that 300 mg/kg of supplemental boron from different sources improved tibia mechanical characteristics.

Eggshell quality has always been a problem in the layer industry. Numerous studies have been conducted to solve the problems of poor shell quality. Many of these studies have focused on macro minerals, especially calcium (Ca) and phosphorus (P). Boron (B) is known to influence a variety of metabolic actions, in addition interacts with Ca, vitamin D, magnesium (Mg), which are all important in bone metabolism (Devirian and Volpe, 2003). Boron has been examined as a possible nutritional factor in Ca metabolism and utilization and thus, as a factor in the development and maintenance of normal bones (NRC, 1994). NRC (1984) suggested that the trace mineral supplements to chemically defined diets should contain at least 2 ppm B. several studies have indicated that B is an important mineral normal bone formation, egg production, eggshell quality parameters in laying hens. Wilson and Ruzsler (1995) investigated the effects of supplemental dietary B on egg production and bone strength of laying hens. No significant differences were observed in the bone shear force, shear stress or the shear fracture energy at any of the B concentrations (3.5, 7, 14, 28 or 56 mg/kg B). Qin and Klandorf (1991) indicated that B did not affect shell quality but increase tibia bone ash. Eren et al. (2004) investigated that dietary B supplementation (0, 10, 50, 100, 200 and 400 mg/kg B) effect on egg production, interior and exterior egg quality in laying hens. The egg quality parameters were affected by the dietary B levels. Yeşilbağ and Eren (2008) reported that supplementation dietary B laying hens better eggshell quality. Olgun et al. (2009) reported that B supplementation had no effect on eggshell thickness and eggshell

breaking strength in molted laying hens. Mızrak and Ceylan (2009) indicated that dietary supplemental B had no effect on tibia and femur breaking strength in laying hens.

The purpose of this study was to determine the effects different sources of B supplementation to diet on eggshell quality and tibia breaking strength characteristics in laying hens.

### 1. MATERIAL AND METHOD

At 44 weeks old 60 laying hens (Super Nick White) were fed to five dietary treatments during the 44-72 weeks periods. Each treatment consisted of six replications of 12 hens (two hens per cage). Five treatments diets consisting of control and plus containing 300 mg/kg boron as boric acids, anhydrous borax, borax pentahydrate and borax decahydrate, respectively. During the experiment, feed and water were used as ad-libitum.

The eggs were subjected to determine characteristics of egg shell quality parameters (shell thickness and shell breaking strength) on all collected eggs produced during 2 consecutive days of per at the end of 28 days period during the experiment. Egg shell breaking strength was measured using a cantilever system by applying increased pressure to the broad pole of the shell using an instrument (Egg Force Reader, Orka Food Technology, Israel). Shell thickness was measured at 3 locations on the egg (air cell and any side of equator) using a micrometer (Mitutoyo, 0.01 mm, Japan).

Table 1

Composition of experimental diet

Ingredients	%
Corn	46.0
Barley	7.4
Soybean meal ( 47.6 % Crude Protein)	22.7
Sunflower meal (30 % Crude Protein)	8.1
Vegetable oil	4.5
Limestone	8.8
Dicalcium phosphate	1.75
Salt	0.40
Premix <sup>1</sup>	0.25
Methionine	0.10
<b>TOTAL</b>	<b>100.00</b>
<b>Calculated nutrients</b>	
ME, kcal kg <sup>-1</sup>	2802
Crude Protein, %	18.05
Calcium, %	3.85
Available phosphorus, %	0.45
Lysine, %	0.892
Methionine, %	0.374
Methionine + Cystine, %	0.714

<sup>1</sup>Premix provided/kg of diet; Mn: 60 mg; Fe: 30 mg; Zn: 50 mg; Cu: 5 mg; I, 1.1 mg; Se: 0.1 mg, Vitamin A, 8.800 IU; Vitamin D<sub>3</sub>, 2.200 IU; Vitamin E, 11 mg; Nikotine acid, 44 mg; Cal-D-Pan, 8.8 mg; Riboflavin 4.4 mg; Tiamin 2.5 mg; Vitamin B<sub>12</sub>, 6.6 mg; Folic acid, 1 mg; D-Biotine, 0.11 mg; Coline: 220 mg

Bone mechanical properties were determined from the load-deformation curve generated from a three point bending test (ASAE Standard S459, 2001) using an Instron Universal Testing Instrument (Model 1122; Instron, Canton, MA) and the TestWorks 4 software package (version 4.02; MTS System Corporation, Eden Prairie, MN). These mechanical properties of bone are described by Wilson and Ruzler (1996) and Armstrong et al. (2002).

Data were subjected to ANOVA by using General Linear Model procedure (GLM) in Minitab (2000). Duncan's multiple range tests were applied to separate means (Duncan, 1955). Statements of statistical significance are based on a probability of  $P < 0.05$ .

## 2. RESULTS AND DISCUSSIONS

The supplementation high level (300 mg/kg B) dietary B from different sources did not significantly effect on eggshell thickness, eggshell breaking strength, tibia shear force during the experiment (44-72 weeks) in laying hens. Tibia bone shear stress and fracture energy were increased by supplemental dietary B (300 mg/kg) from different sources in groups ( $P < 0.05$ ).

Eggshell thickness and eggshell breaking strength were not affected by supplementation of different B sources. According to the results of studies in previous years, Qin and Klandorf (1991), Wilson and Ruzler (1996) and Eren et al. (2004) reported similar results. As a source of boron, boric acid was used in these studies. For this reason, other than boric acid is used and the resources are insufficient to compare the results of the study. The results of the present study, only boric acid, but also anhydrous borax, borax pentahydrate and borax decahydrate, such as B sources used in diets of laying hens have observed.

All sources of B used in the diet of laying hens caused a positive effect on bone stress and bone strength. Wilson and Ruzler (1998) reported that a similar results of laying hens when from 50 to 200 mg/kg B (as boric acid) was added to their diet. Bone stress and bone strength were positive affected by the 200 mg/kg B. In another study, Wilson and Ruzler (1997) reported that there was a significant increase in the shear force and shear stress of the tibia for leghorn pullets supplemented with 50 and 100 mg/kg of dietary B.

Table 2

**Effects of supplemental dietary B (300 mg/kg) from different sources eggshell quality and bone parameters**

	Weeks	Diets					SEM
		Control	Boric Acid	Anhydrous Borax	Borax Pentahydrate	Borax Decahydrate	
Eggshell Thickness, mm	44-48	0.351	0.364	0.367	0.357	0.341	0.0072
	48-52	0.322	0.322	0.322	0.314	0.317	0.0057
	52-56	0.329	0.343	0.351	0.339	0.334	0.0069
	56-60	0.349	0.351	0.348	0.343	0.336	0.0051
	60-64	0.289 <sup>b</sup>	0.301 <sup>ab</sup>	0.324 <sup>a</sup>	0.302 <sup>ab</sup>	0.309 <sup>ab</sup>	0.0075
	64-68	0.330	0.309	0.318	0.307	0.302	0.0076
	68-72	0.323	0.323	0.332	0.325	0.312	0.0068
	44-72	0.328	0.330	0.337	0.327	0.322	0.0044
Eggshell Breaking Strength, kg	44-48	2.93	2.90	3.08	3.14	2.73	0.229
	48-52	2.64	2.77	2.81	2.83	2.70	0.170
	52-56	2.38	2.18	2.65	2.84	2.52	0.303
	56-60	2.35	2.36	2.52	2.42	2.40	0.154
	60-64	2.32	2.61	2.22	2.18	2.17	0.224
	64-68	2.13	2.15	2.41	2.44	2.14	0.201
	68-72	1.56 <sup>B</sup>	1.78 <sup>AB</sup>	2.18 <sup>A</sup>	2.06 <sup>AB</sup>	2.22 <sup>A</sup>	0.129
	44-72	2.33	2.39	2.55	2.56	2.41	0.117
Shear Force, N	596.6	647.2	702.3	694.2	649.7	43.44	
Shear Stress, N/mm <sup>2</sup>	43.15 <sup>b</sup>	52.22 <sup>a</sup>	51.29 <sup>a</sup>	51.54 <sup>a</sup>	48.38 <sup>ab</sup>	1.86	
Fracture Energy, N.mm	465.7 <sup>b</sup>	659.6 <sup>a</sup>	719.4 <sup>a</sup>	650.3 <sup>a</sup>	707.4 <sup>a</sup>	59.85	

A, B: Values in columns are statistically different; P<0.01

a, b: Values in columns are statistically different; P<0.05

### 3. CONCLUSIONS

A results the research indicated that 300 mg/kg of supplemental B from different sources improved tibia mechanical parameters, but not eggshell quality parameters.

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## THE EFFECT OF PRAYMIX BIONORM K ON THE DIGESTIBILITY OF NUTRIENTS BY BREEDING PIGS

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**Key words:** pro-prebiotic, nutrients, pigs, fodder, consumption, digestibility

### SUMMARY

To assess the nutrient digestibility of mixed feed for young pigs supplied with pro-prebiotic preparation Praimix Bionorm K, a physiological experiment has been carried out at the enterprise "Moldsuinhibrid" using 12 Landrace breed gilts. With the gilts in EG<sub>3</sub> which have been fed using fodder in which a quantity of 0.45 kg / t of pro-prebiotic has been added based on lacto- and bifidobacteria, there was a higher increase in digestibility of dry substance, organic substance, crude protein, crude fat and crude cellulose respectively by 1.25, 1.39, 0.74, 1.42 and 33.52% compared with the gilts in CG.

The organization of animal feeding should ensure the conditions for physiological and morphological adaptation of the digestive tract to the efficient use of forage and the regulation of digestion microbiological processes.

The utilization of pro-prebiotics in animal feeding is effective in rations for young agricultural animals. The optimal ratio of microbial flora of gastrointestinal tract of these kinds of animals is easily deflected under the influence of multiple factors such as: the change of the fodder, transportation, treatment with antibiotics, etc [11, 12].

Probiotics are able to survive in the digestive tract, and to improve the digestion and nutrients assimilation processes. They also increase the stamina through improved immune functions [1].

To eliminate the adverse effects of pathogenic microflora and to promote the positive ones, the modification of the composition and catalytic activity of the intestinal microbial flora was proposed via probiotic intake with fodder. Passing along the digestive tract they temporarily colonize it and strengthen the protection functions [3,10].

### 1. MATERIAL AND METHOD

To assess the impact of pro-prebiotic preparation Praymix Bionorm K on the nutrient digestibility in young breeding pigs a physiological experiment was conducted at the enterprise "Moldsuinhibrid".

For the research analogous gilts of Landrace breed were selected, which were grouped into 4 experimental groups: control group (CG) and three experimental groups (EG<sub>1</sub>, EG<sub>2</sub>, EG<sub>3</sub>) [8, 9].

Maintenance and feeding conditions were identical for all experimental animals, except that animals in groups E<sub>1</sub>, E<sub>2</sub> and E<sub>3</sub> received an amount of tested preparation to the basic ration of the mixed feed in conformity with the experiment scheme shown in table 1.

Table 1

**Scheme of the physiological experiment**

Groups	Number of heads per group	Peculiarities of feeding
CG	3	MF – basic mixed feed
EG <sub>1</sub>	3	MF+0.15kg/t Praymix Bionorm K
EG <sub>2</sub>	3	MF+0.30kg/t Praymix Bionorm K
EG <sub>3</sub>	3	MF+0.45kg/t Praymix Bionorm K

The chemical analysis of feed remains and faeces was performed in the laboratory for chemical analysis of the Department of General Animal Husbandry [5].

The results were processed biometrically using the computer program Excel [6, 7].

**2. RESULTS AND DISCUSSIONS**

The feeding was performed using balanced mixed feed according to feeding standards [4].

The structure of the basic mixed feed which was used during the physiological experiment is shown in table 2.

Table 2

**Structure of the mixed fodder used in the physiological experiment**

Ingredients	%
Barley	27.0
Wheat	16.0
Corn	24.0
Wheat bran	12.6
Soybean meal	10.5
Fish meal	2.5
Soybean oil	4.0
Premix 2231	2.0
Chalk	1.4

The growth rate was determined by weighing individual animals. The data on live weight and average daily gain is shown in table 3.

An absolute gain during the period of record of the physiological experiment was obtained in EG<sub>2</sub> and EG<sub>3</sub> – it was higher by 4.1 and 8.1% in comparison with the CG.

Respective the average daily gain per capita was of 0.82 kg in EG<sub>3</sub> which is by 7.8% higher in comparison with CG. During the record period which lasted eight days the intake and faeces were recorded.

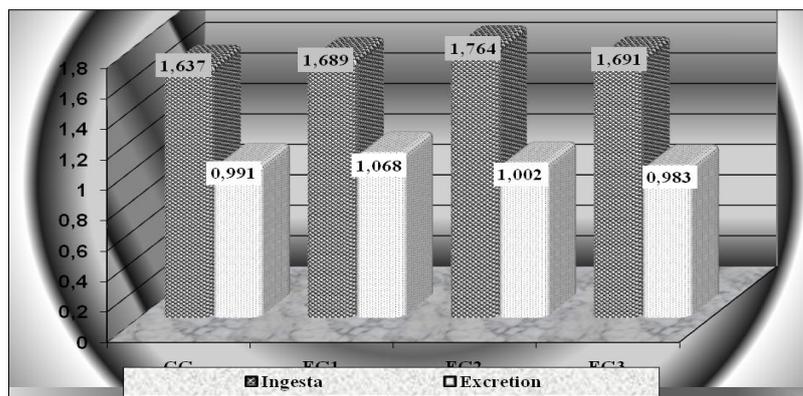
Analyzing the intake it was found out that the gilts in the experimental groups EG<sub>1</sub>, EG<sub>2</sub> and EG<sub>3</sub> consumed more mixed feed respectively by 3.2, 7.8 and 3.3% in comparison with the CG.

Table 3

**Live weight and the weight gain of the animals during the physiological experiment**

Specification	Groups ( $\bar{X} \pm S\bar{x}$ )			
	CG	EG <sub>1</sub>	EG <sub>2</sub>	EG <sub>3</sub>
at the beginning of the preparatory period of the experiment, kg	37.33±2.19	36.00±3.06	37.33±2.85	37.00±4.17
at the beginning of the experimental period, kg	39.61±2.01	38.27±3.13	39.69±2.68	39.45±4.06
at the end of the experiment, kg	45.67±1,77	44.33±3.35	46.00±2.26	46.00±3.79
absolute gain, kg	6.06±0.87	6.06±0.32	6.31±0.53	6.55±0.42
average daily gain, g	0.76±0.11	0.76±0.04	0.79±0.07	0.82±0.05

The data on excretion it was found out that the gilts in EG<sub>1</sub> and EG<sub>2</sub> excreted a bigger quantity of faeces compared with the control group by 7.8 and 1.1% respectively. The gilts the ration of which was supplemented with pro-prebiotic preparation Praymix Bionorm K at the level of 0.45 kg / t excreted a smaller quantity of faeces – by 0.81% compared with the CG.

**Fig. 1. Record of the feed intake and the excretion in the physiological experiment**

The determination of both ingested and excreted nutrients were made at the end of the experiment using media collected samples.

The digestibility of the nutrients of the mixed fodder supplied with pro-prebiotic preparation was assessed by calculating the digestibility coefficients (tab. 4).

Table 4

Digestibility coefficients of nutrients in the physiological experiment

Groups	Indexes	Organic substance	Crude protein	Crude fat	Crude cellulose	Crude non-nitrogenous extractive substances
CG	$\bar{X} \pm Sx^-$	84.87±0.24	77.44±2.22	74.06±1.83	36.90±0.85	91.50±0.29
	S±Ss	0.42±0.17	3.84±1.57	3.16±1.29	1.47±0.60	0.50±0.20
	Cv±SCv	0.49±0.20	4.96±2.02	4.27±1.74	3.97±1.62	0.55±0.22
EG <sub>1</sub>	$\bar{X} \pm Sx^-$	85.04±0.18	75.04±1.56	67.66±4.19	38.30±1.45	93.07±0.41
	S±Ss	0.32±0.13	2.71±1.11	7.26±2.96	2.51±1.02	0.71±0.29
	Cv±SCv	0.37±0.15	3.61±1.47	10.72±4.34	6.56±2.68	0.76±0.31
EG <sub>2</sub>	$\bar{X} \pm Sx^-$	84.96±0.40	73.85±2.34	69.45±2.44	42.02±5.59	92.76±0.57
	S±Ss	0.69±0.28	4.04±1.65	4.22±1.72	9.67±3.95	0.98±0.40
	Cv±SCv	0.82±0.33	5.48±2.23	6.07±2.48	23.02±9.40	1.06±0.43
EG <sub>3</sub>	$\bar{X} \pm Sx^-$	86.05±0.57	78.01±1.43	75.11±1.41	49.27±1.92*	92.22±0.30
	S±Ss	0.80±0.31	2.03±0.83	1.99±0.81	2.72±1.11	0.43±0.17
	Cv±SCv	0.93±0.38	2.60±1.06	2.65±1.08	5.51±2.25	0.46±0.19

\* B=0.95

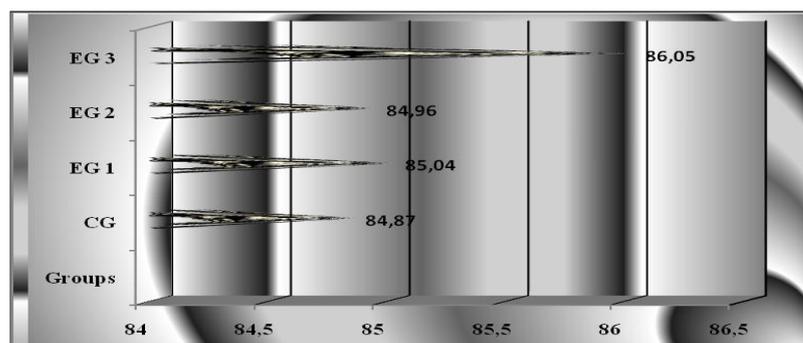


Fig 2. Digestibility of organic substance, %

It was observed that the digestibility of the organic substance was higher in young pigs EG<sub>3</sub> by 1.39% and 1.19% respectively compared with the CG and EG<sub>1</sub>.

Protein digestibility was in the CG 77.44, EG<sub>1</sub> – 75.04, EG<sub>2</sub> – 73.85, and EG<sub>3</sub>– 78.01%, which is 0.74% and 3.96% higher than in the CG and EG<sub>1</sub>.

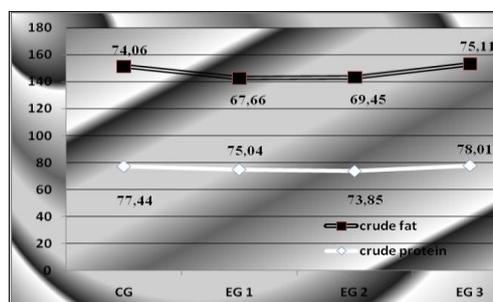


Fig. 3. Digestibility of crude fat and crude protein, %

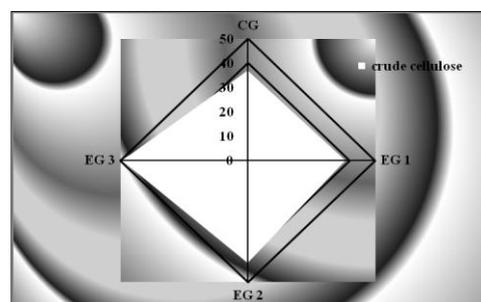
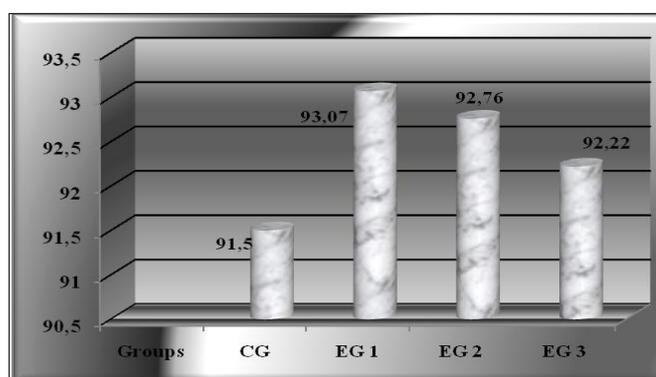


Fig. 4. Digestibility of crude cellulose, %

The digestibility of crude fat was lower in EG<sub>1</sub> – 67.66%. The gilts in EG<sub>3</sub> which received the preparation Praymix Bionorm K at the level of 0.45 kg / t of mixed fodder showed a higher digestibility – by 1.42% compared with the CG, by 11.01% compared with EG<sub>1</sub>, and by 8.15% compared with EG<sub>2</sub>, the ration of which was supplemented with the tested preparation at the level of 0.30 kg / t.

It was observed that the digestibility of crude fibre was the highest in the gilts in EG<sub>3</sub> – 49.27%, which was by 33.52% and 28.7% higher than in the CG and EG<sub>1</sub> respectively.



**Fig 5. Digestibility of non-nitrogenous extractive substances**

Data on the digestibility of non-nitrogen extractive substances showed that the gilts in EG<sub>1</sub> achieved the coefficient of 93.07%. The gilts in the CG and EG<sub>2</sub> achieved the coefficient of 91.50% and 92.76% respectively, which was by 1.69% and 0.3% less than in EG<sub>1</sub>.

### 3. CONCLUSIONS

1. As a result of the supplementation of the basic mixed fodder with pro-prebiotic preparation Praymix Bionorm K at the level of 0.45 kg / t (EG<sub>3</sub>) during the growth of the breeding sows, an absolute increase in weight has been obtained during the physiological experiment, and namely by 8% higher compared with the CG and EG<sub>1</sub>.

2. The digestibility of dry substance has increased by 1.25% in EG<sub>3</sub> compared to the CG, and of the organic substance by 1.39% respectively. The crude protein and crude fat digestibility have been 78.01 and 75.11% in EG<sub>3</sub>, which is 0.74% and 1.42% higher compared to the CG. The level of 0.45 kg / t of the preparation Praymix K Bionorm has a positive influence on the digestibility of crude cellulose at the level of 49.27% in EG<sub>3</sub>, which is higher by 33.52-28.7% in comparison with the CG and EG<sub>1</sub>.

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## USING ENTEROSORBENT PRAIMIX ALFASOB IN FEEDING GROWING PIGLETS

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**Key words:** mycotoxins, sorbents, pigs, mixed feed

### SUMMARY

The aim of the trial was to study the effectiveness of the utilization of the sorbent Praymiks Alfasorb additives and to determine the optimal level of the introduction of these additives into the mixed feed for young pigs.

The studies were conducted at the State Enterprise "Moldsuinhibrid" from 6th of February, 2011 to 6th of April, 2011. A scientific and economic experiment was held using four groups of breeding pigs, selected on the basis of pair analogues of the same breed, live weight and age. It was ascertained that the feed additive Praymiks Alfasorb had a positive effect on the energy of animal growth and their productivity, the young pigs' average daily weight gain increased on average by 6.65-7.90 %, and the feed consumption per unit of output fell by 5.11-16.61%. It was determined that the optimal level of the introduction of the sorbent Praymix-Alfasorb into the mixed feed for growing piglets was 0.2 kg/t.

An important feature of modern pig-breeding is the utilization of intensive technologies and animals with high genetic potential in order to ensure the productivity of livestock through the efficient use of feed nutrients, the maximum preservation of animals and prevention of various diseases, especially among youngsters.

It puts great demands on providing high-quality and environmentally clean forages that are also associated with their pollution with all kinds of toxins, heavy metals, pesticides, and nitrates.

Currently mycotoxins are one of the main pollutants of the harvest of all crops. Some mycotoxins affect plants in the field, others – in the store, in elevators, in vehicles, and even inside the equipment. The most frequently found mycotoxins in forages are mycotoxins DON, T-2 toxin, zearalenone and aflatoxin, and sometimes fusaric acid, fumonisin and ochratoxin A. Most often they contaminate grain-crops, and soy and sunflower meal and pomaces [1].

Nowadays more than 400 mycotoxins are known, which are formed by 350 species of fungi; the available methods of analysis are developed for only a tenth of mycotoxins [2, 3]; the best European laboratories are able to determine not more than 15 kinds of mycotoxins.

In pig production losses from mycotoxicosis are significant: high mortality, forced animal slaughter, a marked decline in productivity, bad reproduction, high treatment expenditures, culling of large masses of feed which causes significant economic damage [4, 5].

The main criteria for the impact of mycotoxins on a swine body are immune suppression, nephrotoxicity and hepatotoxic effects, carcinogenic effects, the

deterioration of productivity (the reduction in food intake, refusal of food intake, poor feed conversion, reduced gains, increased mortality, hypo- and agalactia), haematological disorders, gastrointestinal disorders, bad effects on mares' and boars' reproductive system (impotence, abortion, miscarriages, birth of non-viable offspring), a bad effect on the cardiovascular system, and necrosis.

The research results show that when animals are fed with forages in which the content of zearalenone is 1.1 mg / kg, the features of hyperestrogenia syndrome appear in pregnant and lactating sows; in addition, zearalenone adversely affects the health of animals, but not to the same extent as the more toxic ochratoxin, T2 toxin and DON. T2 toxin and ochratoxin A in mixed forages can not be regulated at all.

It is also significant that the body does not produce antibodies to mycotoxins [5]. To avoid mycotoxicosis, some methods have been developed to prevent or minimize the action of mycotoxins [6, 7, 8, 9]. These methods are mainly focused on the removal of mycotoxins by different adsorbents which are added to the contaminated forages [10]. Currently, researches have been conducted to find the most effective sorbents, which would allow to rid the body of these harmful substances.

In the world practice researches are conducted on testing mineral sorbents based on clay (aluminosilicates, bentonite, dolomite, fulerova land) and organic (mycosorb, mikofiks, Tox-Ex, etc.) adsorbents.

The advantage of organic adsorbent is that they adsorb all the most dangerous mycotoxins; clay adsorbents adsorb mostly aflatoxins, drugs, vitamins, minerals, and amino acids. A sorbent of organic origin is Praymiks-Alfasorb – a drug with a high sorption activity, developed by the scientific and production enterprise "Ariadna."

## 1. MATERIAL AND METHOD

In order to study the effectiveness of influence and to determine the optimum level of the addition of sorbent Praymiks-Alfasorb in the mixed forage for young pigs, at the State Enterprise "Moldsuinhibrid" in the period from 06.02.2011 to 06.04.2011 a scientific and economic experiment was held.

For research 40 head of breeding pigs were selected on the basis of pairs of analogues [11] of the same breed, live weight and age. The selected animals were divided into four groups according to the scheme of investigation (tab. 1).

*Table 1*

**The scheme of scientific experiment**

Groups	Number of animals per group, head	Feeding features
CG	10	Basic mixed forage (BMF)
EG <sub>1</sub>	10	BMF + 0.2 kg/t Praymiks-Alfasorb
EG <sub>2</sub>	10	BMF + 0.4 kg/t Praymiks-Alfasorb
EG <sub>3</sub>	10	BMF + 0.6 kg/t Praymiks-Alfasorb

The piglets in the control group were fed with the basic mixed forage; the peculiarities and differences in feeding were that Praymiks-Alfasorb at different levels was added to the basic mixed forage the animals were fed with.

The scientific and economic experiment consisted of a preparatory period (10 days), the reference period (which was divided into the first and the second periods of breeding). All animals were kept in equal conditions.

The analysis of chemical composition of the forage used in the experiment was carried out using conventional methods of zootechnical analysis [12].

Changes in body weight and growth rate were observed by individual weighing of pigs. Daily records of forage consumption were also conducted. Data derived from the research were processed using the method of variation statistics using the computer program EXCEL [13, 14].

## 2. RESULTS AND DISCUSSIONS

The feeding of pigs in the scientific and economic experiment was carried out in accordance with the accepted feeding standards for breeding piglets [15], taking into account body weight and age. The experimental pigs were fed three times a day using forage prepared in advance according to the recipe adopted at the enterprise (tab. 2).

Table 2

**The mixed feed composition used in the trial, %**

Ingredients	Period of trial	
	Up to 90 days	91-120 days
Corn grain	16.0	24.0
Barley grain	16.7	38.8
Wheat	9.6	21.0
Corn extrusion	10.0	-
Barley grain	13.7	-
Wheat	10.0	-
Soybean meal	12.0	11.3
Wheat bran	6.6	-
Flour from non-food fish	3.0	2.5
Premix	2.0	2.0
Salt	0.4	0.4

The dates on the results of pigs weighing showed (tab. 3), that at the same live weight at the beginning of the accounting period, at the end of the first month of growth under the influence of the introduction of the sorbent Praymiks-Alfasorb the pigs' weight increased in the experimental groups (EG1, EG2, EG3) compared with the CG, respectively, by 14.77 %, 4.61 % and 14.09 %, i.e. the maximum weight was in the group treated with the drug supplement at 0.2 kg / t.

At the end of the second month of breeding the live weight was the greatest in pigs in EG1 (43.45 kg), which was higher by 13.33 % than in the CG, the difference between the mass of pigs in EG2, EG3 and CG, respectively, amounted to 1.56 and 4.56 kg.

Table 3

**The pigs' live weight in the scientific experiment, kg**

Groups	Indicators	on 06.02.2011	on 06.03.2011	on 06.04.2011
CG	$X \pm S_x$	11.60±0.145	23.84±1.457	38.34±2.086
	$S \pm S_s$	0.459±0.103	4.609±1.031	6.597±1.475
	$V, \% \pm S_v, \%$	3.961±0.886	19.091±4.269	16.897±3.778
EG1	$X \pm S_x$	11.86±0.098	27.36±1.541	43.45±2.278
	$S \pm S_s$	0.310±0.069	4.874±1.090	7.205±1.611
	$V, \% \pm S_v, \%$	2.611±0.584	17.813±3.983	16.583±3.708
EG2	$X \pm S_x$	11.87±0.106	24.94±1.414	39.90±0.945
	$S \pm S_s$	0.333±0.075	4.470±1.000	4.228±1.337
	$V, \% \pm S_v, \%$	2.810±0.628	17.923±4.008	10.597±2.369
EG3	$X \pm S_x$	11.71±0.157	27.20±1.383	42.90±2.730
	$S \pm S_s$	0.495±0.111	4.374±0.978	8.634±1.931
	$V, \% \pm S_v, \%$	4.231±0.946	16.199±3.622	20.126±4.500

Table 4

**Average daily gain, kg**

Groups	Indicators	on 06.02.2011	on 06.03.2011	on 06.04.2011
CG	$X \pm S_x$	0.170±0.003	0.418±0.048	0.481±0.029
	$S \pm S_s$	0.008±0.002	0.152±0.034	0.092±0.029
	$V, \% \pm S_v, \%$	4.830±1.080	36.278±0.048	19.243±4.303
EG1	$X \pm S_x$	0.173±0.002	0.517±0.051	0.519±0.044
	$S \pm S_s$	0.006±0.001	0.160±0.037	0.140±0.031
	$V, \% \pm S_v, \%$	3.501±0.783	30.969±6.925	26.894±6.014
EG2	$X \pm S_x$	0.173±0.002	0.436±0.047	0.483±0.017
	$S \pm S_s$	0.005±0.001	0.148±0.033	0.053±0.012
	$V, \% \pm S_v, \%$	3.059±0.684	33.982±7.599	11.061±2.473
EG3	$X \pm S_x$	0.172±0.002	0.510±0.043	0.513±0.052
	$S \pm S_s$	0.007±0.002	0.135±0.030	0.163±0.036
	$V, \% \pm S_v, \%$	4.032±0.902	26.532±5.933	31.771±5.017

The highest average daily growth was observed in the group treated with the sorbent at the level of 0.2 kg/t and amounted, in correspondence with the breeding periods, to 0.513 and 0.519 g.

Based on the data on the quantity of eaten forage and the leftovers, their average consumption by one head per day was calculated, as well as the total amount of eaten forage in the experiment on the average in each group (fig.1).

The analysis of the obtained data showed that during the study period the consumption of mixed forage was lower in comparison with the CG by 11.54kg and 2.69kg respectively in EG1, EG2 and a little bit more (by 2.88%) in EG3.

The data obtained in the experiment on the live weight of the experimental pigs and their forage consumption, allowed us to calculate the expenditures of forage to weight gain.

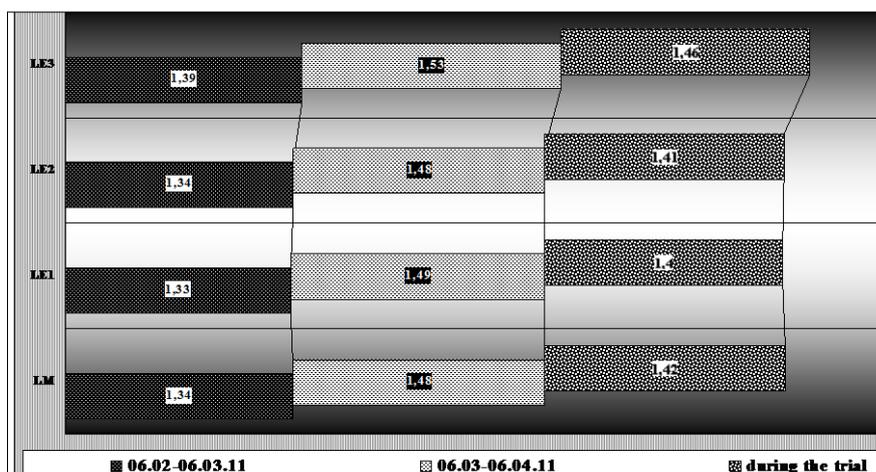


Fig.

1.

Comparative characteristics of forage consumption by a pig on average per day

The analysis of the data on forage consumption by the piglets (tab.5, fig.2) showed that during the study period, these figures were lower on average by 5.11-16.61 % in all experimental groups treated with forage in which the sorbent had been added in comparison with the control group.

Table 5

Feed consumption per 1 kg of increase in body weight

Feed consumption per 1 kg of increase in body weight	Lots			
	CG	EG1	EG2	EG3
During the first month of breeding	3.18	2.43	2.97	2.59
During the second month of breeding	3.08	2.78	2.98	2.92
During the whole period of investigation	3.13	2.61	2.97	2.76
During the whole period of investigation, %	100	83.39	94.89	88.18

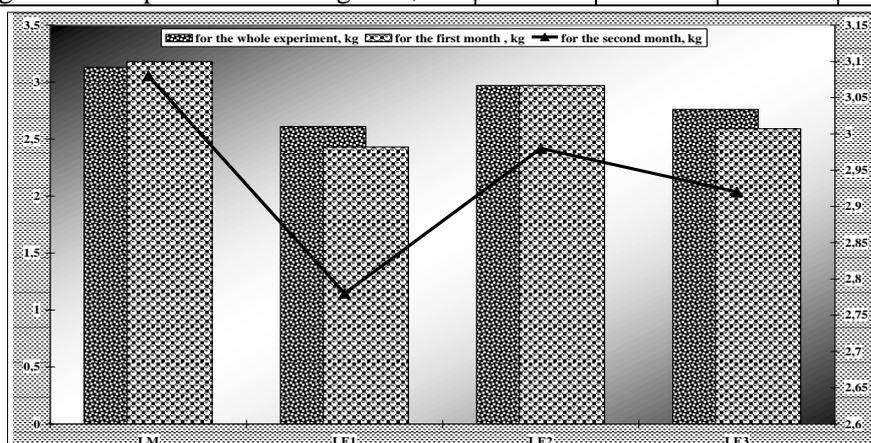


Fig. 2. Feed consumption by the piglets during the trial

### 3. CONCLUSIONS

On the basis of the performed investigations the following conclusions can be made:

1. The utilization of feed additive Praymiks-Alfasorb in the mixed feed for growing piglets has a positive impact on the energy of animal's growth and their productivity, and improves the average daily weight gain of young pigs by an average of 6.65-7.90%.

2. The optimal rate of the sorbent Praymiks-Alfasorb addition in the mixed forage for young pigs during rearing is 0.2 kg / t.

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## **BROAD SPECTRUM ENZYMATIC AGENT RONOZYME WX IN PIG FEEDING**

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**Key words:** young pigs, enzymatic agent, Ronozim WX, compound food, triticales grain

### **SUMMARY**

In scientific and economic experiment it was determined a positive effect of enzymatic agent Ronozyme WX at the rate of 250mg/tonne of compound food, containing 40-50% of triticales grain, on the efficiency of young pigs, digestibility of main nutrients.

Quality of feeding stuffs and adequacy of diets are of decisive importance for realization of biological resources in productivity of animals. In the market conditions, to ensure profitable production of pork, one of the determining chains in the technology is also increase of the effectiveness in feed utilization, which amounts 60-65% in the structure of the output cost price. At the moment, in difficult economical conditions, new sources of feeding stuffs are searched through the use of exogenous enzymes – and it is relatively new trend in the farm animal feeding. Nowadays this problem is quite urgent, as in the diets of nonruminant animals the portion of such raw materials as wheat, rye, triticales i.e. crops, which have along with their good nutrient qualities some negative factors, is going on to increase. This limits the utilization of these crops in feeding, and especially during intensive growth and fattening period [8].

One of the replenishment reserves for forage resources of cereals is triticales. Large-scale work on the selection of winter triticales has been organized over the last decade. A peculiarity of triticales is that along with higher protein content, its grain is characterized by high level of lysine. Triticales is an intermediate product between wheat and rye; however, it partly contains antinutrient factors, coming from wheat and rye [1, 5].

Potential of triticales in feeding of non-ruminant animals is not used by the organism in full, due to the presence of non-starch polysaccharides, to which, first of all, belong pentosans, most part of which form arabinoksilans [2, 3, 7].

In the present time on the market of Russia from a wide range of enzymatic agents is of special interest enzymatic agent Ronozyme WX – a xylanase preparation, which is used for digestion improvement if triticales is included into compound feeds. It is heat-resistant endoxylanase. This enzyme hydrolyses xylans and arabinoksilans into oligosaccharides and some mono-, di- and trisaccharides. IUB system classifies it as endo-1,4- $\beta$ -xylanase. Activity of fungous xylanase is 1000 FXU(w)/g. Enzymatic agents have a form of coated granulate (CT) and keep their activity no less than 12 month at the storage temperature of +25° C and up to two years at +5° C. Use of coated granulated enzymes, has considerable advantages as compared to the use of enzyme powder: proper

distribution and absence of dust, resistance to delamination during the storage process and transportation of the finished compound feed, stability in the composition of premixes and compound feed, stability in the process of hydro-thermal granulation [4, 6].

In this connection we made a research, where the effect of enzymatic agent Ronozyme WX was studied on pig productivity and digestibility of essential nutrients.

### 1. MATERIAL AND METHOD

Trial groups were formed according to the principle of analogue pairs considering breed, origin, age and live weight, 20 heads in each group from the age of 60 days. Feeding conditions for the total number of trial animals were the same. Compound feed contained triticale grain. Compound feed of the trial group differed from the control one only by addition of enzymatic agent Ronozyme WX at the rate of 250g/tonne (table 1). All the investigations were conducted according to conventional methods.

*Table 1*

**Composition of compound feeds of control group by trial periods**

Values	Age, days		
	60-120	121-160	161-195
Barley	29.6	20.0	23.0
Triticale	40.0	50.0	50.0
Wheat bran	10.0	13.7	20.0
Rape-seed cake	7.0	10.0	3.8
Soybean cake	8.0	3.0	-
Fodder yeast	2.0	-	-
Crystalline lysine	0.05	0.14	-
Monobasic calcium phosphate	0.95	0.66	0.7
Chalk	1.0	1.0	1.0
Common salt	0.4	0.5	0.5
Premix P51-1/1	1.0	-	-
Premix P51-7/1	-	1.0	1.0
TOTAL	100.0	100.0	100.0

### 2. RESULTS AND DISCUSSIONS

The study resulted in the following (table 2).

Weighting results of pig youngsters at the age of 120 days of the control group exhibited tendency to live weight increase. Live weight of the young pigs in the trial group was 1.3kg or 2.6% higher than in the control group.

At the end of the study the difference between live weight levels of young pigs in the control group had considerable discrepancy. Supplementation of Ronozyme WX resulted in more intensive growth of animals in the trial group by 7.9kg or 7.6% in comparison with the control group, which had the same compound feed, only without enzymatic agent supplementation.

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Table 2

**Live weight and average daily weight gain of trial animals**

Values	Groups	
	control	trial
Live weight, kg		
Age: 60 days	19.80±0.25	19.60±0.26
120 days	49.50±0.55	50.80±0.52
195 days	104.40±2.3	112.30±1.9*
% to control		107,6
Gross weight gain, kg		
Age: 60-120 days	29.70	31.20
121-195 days	54.90	61.50
60-195 days	84.60	92.70
Average daily weight gain for the period, g		
Age: 60-120 days	495±7.5	520±6.5
121-195 days	732±30.5	820±22.3*
60-195 days	627±17.8	687±13.4*
% to the control	101.5	109.6

\* P<0.05

The analysis of gross live weight gain showed the same tendency as live weight. The highest gross weight gain has been in the trial group over the whole period of growing and fattening and it was 8.1kg or 9.6% higher than corresponding average weight gain in the control group.

Starting from the first, 60 to 120-day old period, the trial group shows a tendency of higher average daily weight gain as compared to the control one. The second period of study, from 121 to 195-day old, showed average daily weight gain 88g or 12.0% higher than in the control group (P<0,05). Consequently, average daily weight gain has been 60g or 9.6% higher in the trial group over the whole period of growth and fattening (P<0.05).

Resulted from more intensive rate of live weight gain in the trial group, the age, when the live weight of animals amounted 100kg, was 13 days reduced, as compared to the control group, which consequently increased the efficiency of growing of pigs youngsters.

At the expense of higher growth rate of animals in the trial group food conversion rate per 1kg if weight gain was 0.29 energy food units (EFU) lower, than in the control

group. And as a result, digestible protein conversion rate per 1kg of weight gain in the trial group was 36g lower than in the control one.

A physiological test was carried out to determine the effect of enzymatic agent Ronozyme WX on digestibility of essential nutrients at the age of 4.5 months (table 3).

Analyses of the data given in the table allows to draw a conclusion that pig youngsters of the trial group showed higher results in all studied points than their analogues from the control group. Thus, digestibility of dry matter in the trial group was 3.1 % and 3.4% higher ( $P < 0.05$ ) than in the control one.

Protein digestibility of the ration was 1.9% higher in the trial group as compared to the control one, where identical compound food was fed with enzymatic agent Ronozyme WX.

Table 3

**Digestibility of essential nutrients from diets of trial animals, %**

Values	Group	
	control	trial
Dry matter	73.9±0.58	77.0±0.52*
Protein	73.2±0.67	75.1±0.54*
Fat	56.3±0.68	59.1±0.63*
Fiber	33.3±0.64	36.2±0.60*
NFE	85.0±0.68	87.6±0.58*

\* $P < 0.05$

Additional supplementation of the enzymatic agent into compound food had positive effect on fiber digestibility in the control group as compared to compound food of the control group, digestibility improvement amounted 2.9%.

In order to get real evaluation of feeding conditions the efficiency of forage nitrogen utilization by trial animals was estimated as a result of data processing of physiological trial (table 4).

Table 4

**Nitrogen balance of trial animals, g**

Values	Groups	
	Control	Trial
Taken with feed	66.9±0.31	6.,1±0.29
excreted: in feces	17.9±0.45	16.7±0.38
in urine	24.2±0.32	23.8±0.27
Digestibility	49.0±0.60	50.4±0.48
Deposited	24.8±0.64	26.6±0.60
Utilized, %		
from taken	37.1±0.79	39.6±0.58
from digested	50.6±0.46	52.8±0.54

All animals of experimental groups during the physiological trial had positive nitrogen balance.

The highest percentage of nitrogen utilization of the amount taken was in the trial group; the same regularity occurred with nitrogen utilization as percentage of the digested amount.

Content of major mineral elements in the diets of pigs has considerable effect on growth and development of pig youngsters. Proceeding from this, the effect of enzymatic agent Ronozyme WX on mineral metabolism of hilt in the trial was estimated by calcium and phosphorus balances. Average data on utilization of these elements by the animals during the physiological trial are shown in table 5.

It is determined that calcium and phosphorus balance of all trial animals was positive.

Table 5

**Calcium and phosphorus balance of animals, g**

Indexes	Group	
	Control	trial
Calcium		
Taken with feed	24.4±0.12	24.4±0.10
Excreted: in feces	11.7±0.10	11.4±0.11
in urine	0.5±0.02	0.5±0.01
Balance	12.2±0.12	12.5±0.08
Utilized from taken, %	50.2±0.30	50.2±0.22
Phosphorus		
Taken with feed	20.3±0.11	20.3±0.09
Excreted: in feces	10.1±0.09	9.9±0.08
In urine	0.7±0.02	0.7±0.02
Balance	9.5±0.11	9.7±0.06
Utilized from taken, %	46.7±0.28	47.8±0.25

Calcium balance of trial animals in compared groups ranged from 12.2 to 12.5g and reliable differences were not determined. Though tendency to digestibility improvement of this element in the compound food with the addition of enzymatic agent Ronozyme WX, however, was observed.

Daily phosphorus deposition ranged from 9.5 to 9.7g in pig youngsters of all groups, but in acceptable intervals without any significant difference. The level of phosphorus utilization of acceptable quantity ranged from 46.7 to 47.8%, but significant differences between compared groups were not determined.

In whole, it should be noted that under the effect of exogenous enzymatic agent, there was intensification of gastrointestinal metabolism of trial animals, and this, in turn, positively reflected in digestibility and utilization of food nutrients, especially in pig youngsters of the trial group.

Blood is a certain liquid tissue of the organism, which reflects its physiological condition. It provides the interaction of all organs and systems among themselves and the organism as a whole with the external environment. Metabolism in the organism of pigs as in the other live organisms, conditioned by complicated biochemical reactions of all

biologically active and nutritive matters, coming with food, water and producing in the organism.

To determine the degree of the effect of enzymatic agent Ronozyme WX on the pig organism were carried out hematological analyses (table 6).

Haemoglobin is a respiratory blood pigment, which consists of globin protein and prosthetic group – gem. It is a chelate complex of protoporphyrin with bivalent iron. The main function of haemoglobin is to carry oxygen from lungs to tissues. Haemoglobin participates in transportation of carbonic acid gas from tissues to lungs, in maintenance of acid-base balance in the organism, i.e. possesses buffer characteristics. Owing to the addition of enzymatic agent Ronozyme WX into the diets of pig youngsters, the amount of haemoglobin in the blood of the trial animals showed rising tendency.

Determination of crude protein in blood serum provides insight to the level of protein feeding. Concentration of crude protein in serum mainly depends on syntheses and degradation of the two main protein fractions – albumin and globulins. Addition of enzymatic agents to the composition of compound food for the trial group had positive effect on the crude protein content in the blood.

Table 6

**Morphological and biochemical blood values of animals**

Values	Group	
	Control	trial
Erythrocyte, $10^{12}/l$	5.86±0.19	6.00±0.18
Leukocyte, $10^9/l$	18.2±0.70	18.3±0.60
Haemoglobin, g/l	105.9±2.3	109.0±2.2
Reserve alkalinity, Bodansky Unints	488.0±6.7	490.0±6.5
Whole protein, g/l	74.2±1.19	75.2±1.10
Calcium, g/l	9.73±0.15	9.84±0.10
Phosphorus, g/l	6.18±0.10	6.22±0.07

The condition of mineral metabolism of growing pigs was judged by calcium and phosphorus content in the blood. Phosphorus is one of the principal structural elements of the organism. All kinds of metabolism in the organism are inseparably connected with the transformation of phosphoric acid. Phosphorus takes an active part in collagen formation – an organic matrix; an enzyme – alkaline phosphatase, contributes to this process, transporting phosphorus ions to the organic bases of the bone tissue.

Calcium is one of the most important chemical elements, which is necessary to provide vital processes of animals. The level of the whole calcium in the blood is determined by the sum of ionized, linked up to the blood protein and different anions calcium. Calcium concentration in the blood – is quite constant.

It is determined that the content of these elements in the blood of trial animals was within physiological standard and without essential differences.

Table 7

**Results of control slaughter**

Values	Group	
	Control	Trial
Preslaughter live weight, kg	104.0±1.8	108.7±1.5
Slaughter weight, kg	64.6±1.42	71.2±1.58
Slaughter output, %	62.1±1.45	65.5±1.4*
Carcass length, cm	91.4±1.72	93.0±1.54
Depth of pig fat above 6-7 thoracic vertebra, mm	25.6±0.67	24.5±0.43
Area of «muscular eye», cm <sup>2</sup>	33.1±0.7	36.0±0.5*
Weight of back third of half carcass, kg	10.5±0.41	11.5±0.32

\* P&lt;0.05

Evaluation of physiological condition of the animals, consuming enzymatic agent as a part of compound food, points to the fact that its supplementation did not have any negative effect on the metabolic processes of the growing and fattening pig youngsters.

Upon completion of scientific and economic experiment control slaughter of animals was carried out. Four animals of average live weight were taken from each trial group. Basic data, obtained as a result of control slaughter are shown in table 7.

Preslaughter live weight reflected average live weight of animals in groups at the end of the experiment and therefore there is difference in values.

In relation to animals of the control group, young pigs of the trial group that had compound feed with enzymatic agent Ronozyme WX, tend to indicate increase in slaughter weight.

Considering that a long spine muscle has not only significant meat content of a carcass but contains best kinds of meat, area known as a “muscle eye” was also considered in the research. By this index best results were obtained in the trial group and exceeded control by 8.8%.

After control slaughter of studied animals, indexes of morphological composition of carcasses were analyzed; results are shown in table 8.

Table 8

**Morphological composition of half carcass of trial animals**

Values	Group	
	Control	Trial
Meat, kg	18.8	21.4
%	58.2	60.0
Fat, kg	10.0	10.2
%	31.0	28.9
Bones, kg	3.5	4.0
%	10.8	11.1

Study of morphological composition of slaughter pig carcasses of all experimental groups showed certain differences.

There was quite high meat yield of pigs from all experimental groups. But the highest meat yield was in the trial group which consumed compound food supplemented with enzymatic agent. Use of enzymatic agent positively resulted in increase of meat; thus, trial group had 1.8% meat more as compared to the control one.

### 3. CONCLUSIONS

Positive effect of enzymatic agent Ronozyme WX on the performance of pig youngsters was determined as a result of the conducted research. It is recommended to add enzymatic agent Ronozyme WX at the rate of 250g/tonne into compound food for pigs, containing triticale.

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## EFFECTS OF CORN DISTILLERS DRIED GRAIN WITH SOLUBLES (DDGS) ON CARCASS, MEAT QUALITY AND INTESTINAL ORGAN TRAITS IN JAPANESE QUAILS

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**Key words:** DDGS, quail, carcass, inner organ, meat quality

### SUMMARY

Corn distillers dried grains with soluble (DDGS) is a by-product of the ethanol industry and also it can be obtained from wheat, barley, sorghum and other carbohydrate sources in ethanol plants. It has high protein and energy content therefore can be evaluated as a by-product for poultry. However, its high levels in poultry diets have been restricted due to some negative effects on poultry performance and carcass traits. Although, there are some studies usage of DDGS in broiler, layer and turkey diets but no in quail diets. The objective of this study was to determine the effects of corn *distillers* dried grains with solubles (**DDGS**) on carcass, meat quality and inner organ traits in Japanese quails (*Coturnix coturnix japonica*). A total of 240 one-day-old mixed sex quail chicks were individually weighed, wing banded and distributed into 4 treatments with 4 replicate and 12 chicks per cage. The replicates were designated as the experimental units, and were randomized with respect to the dietary treatments. Maize-soybean based diets were utilized and all were formulated using linear programming to be isoenergetic, isonitrogenic and to contain the equal level of dry matter, crude fiber and ash, calcium, available phosphorus, sulphur amino acids and lysine. Therefore, the treatments were: (1) control no addition DDGS (C), (2) 10 % DDGS of diet (3) 20 % DDGS of diet and (4) 30 % DDGS of diet. The experimental diets were used for 35 days of age. For carcass evaluation 16 birds each group were randomly selected at 35 d of age and slaughtered. Whole carcass, liver, stomach, gizzard, duodenum, ileum+ jejunum, secum, colon, abdominal fat, heart and pancreas weights were recorded individually and part yields were obtained as part weight: carcass weight ratio. To determine meat composition a total of 64 meat samples were analyzed for dry matter, nitrogen, ether extract and crude ash. There were no differences among the groups in terms of slaughter weight, carcass, and edible organs, some gastrointestinal organs except secum and pancreas and abdominal fat weights. In the control group's secum weight was high than all of supplemented DDGS groups and fed diets with 30 % of DDGS groups was lower secum weight than other groups ( $p<0.05$ ). Also pancreas weight of the control group was higher than fed diets with 10 and 30 % of DDGS included groups ( $p<0.05$ ), but 20 % of DDGS was not different. There were similar trend percentages of these traits. The secum percentage of DDGS 30% group was lower and significantly different than other groups and control groups' secum percentage was higher than other groups ( $p<0.01$ ). The pancreas percentage of DDGS 30% group was significantly lower than the control and DDGS 20% groups ( $p<0.05$ ). In the 20 % DDGS group DM was significantly higher than other groups ( $P<0.01$ ), however among the 0, 10 and 30 % DDGS group's differences were not significant. Similarly, the meat CF in 20 % of DDGS of diets was higher than C and 10 % DDGS groups ( $p<0.05$ ), but fed with 30 % DDGS groups meat CF was not significantly differed. The meat CP and CA values were not significant among the experimental groups. In conclusion, quails can be fed between 0 and 30% DDGS, if diets are formulated appropriately, without negative affect on carcass, meat and inner organ traits.

Corn distillers dried grains with soluble (DDGS) is a by-product produced from different grains in ethanol plants. It has high protein and energy content therefore can be evaluated an important feedstuff as a by-product for all animal groups (Lumpkins et al., 2004). However, previously researches reported that the DDGS sometimes has low product quality and nutritional variability (Kim et al., 2008; Salim et al., 2010; Liu et al.,

2011). Today, because of new technologies used in ethanol production have been improved the DDGS quality and its availability is better than before (Salim et al., 2010). Youssef et al. (2008) reported that in broilers up to 15% DDGS and in turkeys up to 20% in grower and finisher diets is possible. However, there is not enough research DDGS in quail diets and poultry carcass characteristics. Also, its high levels did not recommend due to negative effect on performance (Wang et al., 2007a, b; Loar et al., 2010) and carcass traits (Wang et al., 2007a, b; Wang et al., 2008; Min et al., 2008).

It is known that feed kind and composition can influence on poultry meat components and quality traits. There are insufficient researches effect of DDGS on meat components and quality in poultry. Corzo et al. (2009) and Schilling et al. (2010) reported that high ratios of DDGS in broiler diets can change some meat traits. Therefore, the aim of this research was to determine the effects of corn DDGS usage at 0, 10, 20 and 30 % levels in quail diets on internal organ traits and meat parameters.

### 1. MATERIAL AND METHOD

A total of 240 one-day-old mixed sex quail chicks were individually weighed, wing banded and distributed into 4 treatments with 4 replicate and 12 chicks per cage. Maize-soybean based diets which similar nutrient profile was utilized. The treatments were: (1) C no addition DDGS (C), (2) 10 % DDGS of diet (3) 20 % DDGS of diet and (4) 30 % DDGS of diet. Diet feedstuff and nutrient composition was given in Table 1.

For carcass evaluation 16 birds each group were randomly selected at 35 d of age and slaughtered. Their feathers were plucked mechanically, eviscerated by hand. Whole carcass, liver, stomach, gizzard, duodenum, ileum+ jejunum, secum, colon, abdominal fat, heart and pancreas weights were recorded individually and part yields were obtained as part weight: carcass weight ratio. Cold carcass weight was recorded after carcasses were kept at +4°C for 18 h. To determine meat composition a total of 64 meat samples were collected and analyzed for dry matter, to calculate crude protein (as Nitrogen, CP), crude fat (CF) and crude ash (CA) (AOAC, 1980). Data were subjected to ANOVA using General Linear Models (SAS, 1996). Means were separated using Duncan's multiple range tests.

### 2. RESULTS AND DISCUSSIONS

The Effects of DDGS levels on carcass yield, inner organs and gastrointestinal system traits and carcass composition were presented in the Table 2. There were no statistically significant differences among the groups in terms of slaughter weight, carcass, and edible organs, some gastrointestinal organs. However, in the C group's secum weight was higher than all of supplemented DDGS groups and also fed diets with 30 % of DDGS groups secum weight was lower than other groups ( $p < 0.05$ ). The pancreas weight of the C group was higher than 10 and 30 % of DDGS groups ( $p < 0.05$ ), but 20 % of DDGS was not different. There was a similar trend the percentages of these traits. The secum percentage of DDGS 30% group was lower and significantly different than other groups. The C groups secum percentage was higher than other groups ( $p < 0.01$ ). The

pancreas percentage of DDGS 30% group was significantly lower than the C and DDGS 20% groups ( $p < 0.05$ ).

Table 1

Ingredients, kg	Diets			
	Control	DDGS 10 %	DDGS 20 %	DDGS 30 %
Maize	556.41	497.31	438.22	378.90
Soybean meal	407.64	361.86	316.07	270.33
Dried dehydrated grain soluble	0	100.0	200.0	300.0
Vegetable oil	6.07	12.37	18.67	25.04
DL-Methionine	1.36	1.30	1.24	1.18
L-Lysine	1.02	1.44	1.86	2.28
Limestone	13.82	14.43	15.04	15.64
Salt	3.55	2.33	1.11	0
Di-calcium phosphate	7.63	6.46	5.29	4.13
Vitamin and trace mineral premix <sup>1</sup>	2.50	2.50	2.50	2.50
<i>Calculated Composition</i>				
Dry matter, g/kg	88.94	89.20	88.78	89.12
Crude protein, g/kg	24.00	24.02	24.01	24.06
Crude fiber, g/kg	3.05	3.06	3.02	3.04
Lysine, g/kg	13.0	13.0	13.0	13.0
Methionine, g/kg	5.0	5.0	5.0	5.0
Calcium, g/kg	8.0	8.0	8.0	8.0
Available phosphorus, g/kg	3.0	3.0	3.0	3.0
ME, kcal/kg	12.14	12.14	12.14	12.14

<sup>1</sup>Supplied per kg of the feed: Vitamin A, 15000 I.U; Vitamin D3, 2000 I.U; Vitamin E, 40.0 mg; Vitamin K, 5.0 mg; Vitamin B1 (thiamin), 3.0 mg; Vitamin B2 (riboflavin) 6.0 mg; Vitamin B6, 5.0 mg; Vitamin B12, 0.03 mg; Niacin, 30.0 mg; Biotin, 0.1 mg; Calcium D-pantothenate, 12 mg; Folic acid, 1.0 mg; Choline chloride, 400 mg; Manganese, 80.0 mg; Iron, 35.0 mg; Zinc, 50.0 mg; Copper, 5.0 mg; Iodine, 2.0 mg; Cobalt, 0.4 mg; Selenium, 0.15 mg.

Some research results similar as our results but they used lower percentage of DDGS than our experiment in quails up to 20 % DDGS (Konca et al., 2010) and in broilers diets and up to 18 % DDGS was not affected on carcass yield (Lumpkins et al., 2004). In contrast to our results Wang et al. (2007c), Wang et al. (2008) and Min et al. (2008) reported that 30 % DDGS levels caused a decrease in carcass yield in broilers. Loar et al. (2010) reported that increasing from 8 to 25 DDGS inclusion levels during the grower phase resulted in a linear decrease ( $P < 0.001$ ) in liver relative weight. Wang et al. (2007a) reported that inclusion of 15 or 25% DDGS decreased the dressing percentage, and chickens fed the diet with 25% DDGS was characterized by lower breast weight.

Table 2

**Effects of DDGS levels on carcass yield, inner organs and gastrointestinal system traits and carcass composition**

Traits, %	DDGS level, %				SEM	P
	0	10	20	30		
Slaughter weight	158.9	158.8	163.6	163.4	3.55	0.638
Carcass	112.7	110.8	116.5	116.5	2.35	0.229
Liver	3.62	3.33	3.26	3.26	0.20	0.516
Stomach	0.84	0.79	0.77	0.77	0.05	0.717
Gizzard	3.69	3.58	3.97	3.82	0.15	0.286
Duodenum	2.01	1.71	1.94	1.83	0.10	0.181
Ileum+ jejunum	4.43	4.23	4.44	4.01	0.25	0.585
Secum	1.49 <sup>a</sup>	1.25 <sup>b</sup>	1.28 <sup>b</sup>	1.02 <sup>c</sup>	0.08	0.001
Colon	0.38	0.45	0.43	0.38	0.04	0.377
Abdominal fat	0.556	0.788	0.781	0.781	0.13	0.504
Heart	1.20	1.30	1.43	1.34	0.06	0.071
Pancreas	0.550 <sup>a</sup>	0.444 <sup>ab</sup>	0.537 <sup>a</sup>	0.3630 <sup>b</sup>	0.05	0.019
<i>Percentage of carcass %</i>						
Carcass	70.95	69.92	71.24	71.34	0.62	0.357
Liver	3.199	3.00	2.79	2.77	0.14	0.119
Stomach	0.75	0.72	0.66	0.66	0.041	0.328
Gizzard	3.29	3.24	3.41	3.28	0.13	0.788
Duodenum	1.79	1.56	1.67	1.57	0.10	0.294
Ileum+ jejunum	3.94	3.83	3.82	3.43	0.22	0.366
Secum	1.34 <sup>a</sup>	1.13 <sup>b</sup>	1.09 <sup>b</sup>	0.88 <sup>c</sup>	0.07	0.000
Colon	0.33	0.41	0.37	0.33	0.03	0.231
Abdominal fat	0.48	0.69	0.66	0.65	0.10	0.472
Heart	1.07	1.17	1.22	1.15	0.04	0.098
Pancreas	0.49 <sup>a</sup>	0.41 <sup>ab</sup>	0.46 <sup>a</sup>	0.32 <sup>b</sup>	0.04	0.027
<i>Carcass composition</i>						
Dry matter	25.68 <sup>b</sup>	25.88 <sup>b</sup>	26.55 <sup>a</sup>	25.97 <sup>b</sup>	0.17	0.005
Crude protein	22.24	22.69	22.68	22.35	0.19	0.247
Crude fat	2.45 <sup>b</sup>	2.40 <sup>b</sup>	2.81 <sup>a</sup>	2.57 <sup>ab</sup>	0.09	0.007
Crude ash	1.31	1.35	1.46	1.35	0.05	0.193

SEM: pooled standard error of the means; P: probability; NS: non significant. <sup>a, b</sup>: Means within a column different alphabet are significant; \*(P<0.05).

In the 20 % DDGS group DM was significantly higher than other groups (P<0.01), however among the 0, 10 and 30 % DDGS group's differences were not significant. Similarly, the meat CF in 20 % of DDGS of diets was higher than C and 10 % DDGS groups (p<0.05), but fed with 30 % DDGS groups meat CF was not significantly differed. The meat CP and CA values were not significant among the experimental groups. These results showed that quails when fed 0 to 30 % DDGS there was a trend in increase of the DM and CF (without 10% DDGS) content of meat. Schilling et al. (2010) reported that

there were no differences among the groups fed with 0, 6, 12, 18 and 24% DDGS in terms of DM, CP and CF in broilers breast and thigh meat, and they claimed that broilers can be fed between 0 and 24% DDGS, if diets are formulated appropriately, without affecting muscle tissue composition. In contrast to these results, Shim et al. (2011) reported that broilers fed 0 to 24% DDGS carcass CF of female broilers decreased with increasing DDGS levels in the diet. There is no enough research related to affects of DDGS on poultry carcass composition, therefore we couldn't compare our results sufficiently. These results showed that quails when fed 0 to 30 % DDGS there was a trend in increase of the DM and CF (without 10% DDGS) content of meat.

### 3. CONCLUSIONS

If quail diets are formulated appropriately can be fed between 0 and 30% DDGS without negative affecting carcass, meat quality and inner organ traits.

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## NUTRITIONAL SOFTWARE TO FORMULATE AND EVALUATE FEED RATIONS TO SHEEP AND LAMBS

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**Key words:** nutritional software, feed ration optimization, sheep requirements calculus, nutritional value of feedstuffs, ration efficiency

### SUMMARY

The software for the formulation and calculation of feed rations for sheep and lambs includes modules that allow nutritionists / farmers to undertake the following activities: Evaluation of the nutritional characteristics of the ingredients from the composition of feed rations for sheep and lambs; Defining specific fodder data base, calculation of nutritional requirements for sheep and lambs depending on age, weight, sex, living environment, physical activity, commercial type and economic performance desired (growth, quality of growth, milk production). Formulation and ration calculation for user selected animal, estimated efficiency ratio set by the user for selected animal. The software developed is an important logistical support for further development of research in the field, as an effective nutritional tool to improve feed and fodder use for sheep and lambs growth and improvement towards the desired economic performance. To achieve the above functions the software for the formulation and calculation of nutritional rations contains three modules: Evaluation for nutritional values of feedstuffs; Calculus for nutritional requirements for sheep and lambs; Conception, calculus and estimation on a ration's efficiency module. The first module, which relates to evaluation for nutritional values in sheep feed and lambs rations, contains a data base with specific items for nutritional metabolism of sheep. Feedstuffs are divided on multiple level, generally noted as: Group, Subgroup, Type, Subtype, Product, By-product.

The main nutrients considered to evaluate nutritional values in sheep feed rations are: brute energy, total proteins, total nitrogen, aminoacids, total fats, cellulose, ashes, humidity, vitamins and minerals.

The data basis includes two parts: a references data base, containing standard values for products with established values, given by the reference feedstuff, and an user data base with complete access regarding adding or correcting data given by the lab tests.

The reference data provides evaluation methods for nutrient calculus, conforming to the methods elaborated in cooperation with specialists from INCDZ Balotesti.

The module for calculation the nutritional requirements for sheep and lambs formulates the calculus for nutritional requirements, based on mathematic models, and performs the selection for nutritional requirements from a data base with nutritional specifications.

The module for conception, calculus and estimation on a sheep feed rations's efficiency permits to set up a feed ration conforming to nutritional requirements established by the model, nutritionist or user and to provide a degree of fulfillment for nutritional requirements in a feed ration. An efficiency report shows the lack or excess of nutrients, so the user could take a corrective measure. Rations are calculated in kilograms of fodder a day.

Determination of optimal and balanced dietary nutrition for sheep and lambs is a complex process that requires the integration of a large volume of data and information. A sheep ration's conception and evaluation, by elaborating a software application, refers to creating applicative modules that are acting as:

- Defining a nutritional data base
- Evaluation of nutritional characteristics for ingredients contained by sheep feed rations

- Calculating the sheep nutritional requirements
- Formulation and evaluation on a feed ration

This software application is an important logistical support to consequently develop a basis research and also an efficient tool for nutritionists and farmers, in order to improve the use of fodder for sheep and achieve desired growth and/or milk production and improve economic performance. The nutritional software SINGOVIN, created in a team effort with specialists from SIAT Bucharest, University of Agronomical Sciences and Veterinary Medicine Bucharest, and National Institute for Research and Development in Zootechny Balotesti, represents the reference element to create a usefull simplified nutritional instruments for farmers.

### 1. MATERIAL AND METHOD

This research intend to elaborate and develop scientifically sustained methods and instruments for calculus and formulation of nutritional sheep diets, in order to ensure nutrient requirements for obtaining a gain of weight, meat quality, milk production and economic efficiency (price cost). This is a complex investigation, including characteristics related to studying and elaborating of a scientific support, as parts of the sheep nutritional system, as well as to practical applicability by designing and elaborating the software for formulate and calculating a daily feed ration.

With the purpose of fulfilling the above mentioned functions, the software for conception and calculus on a feed rations, includes 3 modules:

- a module for evaluation of nutritional values in feedstuffs
- a module for calculus of nutritional requirements
- a module for conception and estimation on a diet's efficiency

The first module, which relates to evaluation for nutritional values in sheep feeding, contains a data base with specific items for nutritional metabolism of sheep. Feedstuff are divided on multiple level, generally noted as: Group, Subgroup, Type, Subtype, Product, By-product.

The main nutrients considered to evaluate nutritional values in sheep feeding are: brute energy, total proteins, total nitrogen, total fats, available carbohydrates, total carbohydrates, cellulose, ashes, humidity, A vitamin, beta-carotenes, D vitamin, E vitamin, sodium, potassium, calcium, magnesium, phosphor, iron, copper, zinc, iodine, manganese, selenium, amidone, total nutritional cellulose, isoleucine, leucine, lysine, methionine, cistine, phenylalanine, tyrosine, threonine, tryptophan, valine, arginine, histidine, alanine, aspartic acid, glutamic acid, glicine, proline, serine, fatty acids.

The data basis includes two parts: a references basis, including standard values for products with established values, given by the reference feedstuffs, and a user basis, with complete access regarding adding or correcting data given by the lab tests. The number of considered nutrients is highly enough to permit a hypothesis formulation and a fair analysis towards studied effects.

The software structure is an important factor establishing an easy access to a data basis. For our application, the data base requires a MICROSOFT ACCESS format.

Food requirements are minimum quantities of nutrients provided to one sheep in order to meet maintenance needs, achieving a gain in weight and a higher quality and/or milk production. Energy, protein, essential AA, vitamins, macro and microelements requirements are calculated for all sheep body functions, including: maintenance, physical activity, body weight gain, milk production depending on age / weight, sex, race.

The software modules are written with MICROSOFT VISUAL C, they have a dynamic character and promotes the development as an user application.

## 2. RESULTS AND DISCUSSIONS

The nutritional software SINGOVIN is an application written with MICROSOFT VISUAL C and uses Windows specific tools and controls. SINGOVIN includes seven menus: File, Edit, Tools, View, Window and Help. File, Edit, View and Window comprise submenus, with standard Windows associated functions and commands. Tools has submenus used to select a particular window and specific commands to elaborate file proceedings on nutrient requirements, diet formulation and evaluation; Help menu contains the interactive on-line manual.

The following is a description of the main dialog windows, including associated functions and commands.

**The module for evaluation of nutritional values in fodder** is conceived as a view and edit screen for data basis. It represents a modeless dialog, with tab controls associated to nutrients group and some universal controls.

- Tab controls allow dealing with nutrient's characteristics, as grouped: Brute Chemical Composition, Amino Acids, Macro-elements, Micro-elements, Vitamins, Fatty Acids.

- Universal controls include:  
Selection controls for current data base; Nutritional tree; Data basis navigation controls (first, last, previous, next, any leap); Viewing controls for data basis status (current position in data basis, total number of categories and nutrients, code, ID, nutrient situation on the tree); Searching and sorting controls, considering particular characteristics; Adding, modifying and deleting controls (categories and nutrients); Other controls (copy, past, reread, "white" article (=uninitialized)).

Example: Brute chemical composition for a feedstuff:

Vizual DB...

Macroelemente    Microelemente    Vitamine    Digestibilitati

Compozitia Chimica Bruta    Aminoacizi    Acizi grasi

Comp. Chim. Br.:

Cenusă brută:  [g]

Proteina brută:  [g]

Grăsimi brută:  [g]

Celuloză brută:  [g]

Produse ferment.:  [g]

Energie brută:  [MJ]

VSV:

VST:

VSD:

TipN:

CP:

Baza de date:  OVI  PALAS  ALT

Cautare:  ID  Cod

Sortare:  A ID  D  NS

Mou:

Stergere:

PAS 203 XNU 132  
203 294

CONCENTRATE

GRAUNTE\_SI\_SEMINTE\_CU\_SUBPRODUSE

GRAMINEE

Porumb\_cu\_subproduse

BOABE

GALBEN

3.11.01

267

Nutret\_Sel

- C FIBROASE
  - + C VERZI
  - + C FINURI
  - + C INSILOZATE
  - + C SEMISILOZURI
- + C GROSIERE
- + C SUCULENTE
- C CONCENTRATE
  - C GRAUNTE\_SI\_SEMINTE\_CU
    - C GRAMINEE
      - C Porumb\_cu\_subprc
        - C BOABE
          - R GALBEN
          - R ALB
        - + C STIULETI
        - R TARATE

**Fig. 1. "Brute chemical composition" Tab**

The module for calculus of nutritional requirements is carried out as a necessary evaluation screen (energy, protein, etc.), based on an individual description. It is realized with tab controls, including:

- A tab for user requirements generated by the model. Model calculations are based on energy, protein, dry matter and macroelements requirements. For sheep the model contains informations about young sheep, sheep in gestation and/or lactation and rams.

Norma: oi\_40\_250.ovi

Initializari norma | Descriere animal | Productie Lapte | Mediu | Palas | Standard | Descriere\_animal\_oi | Rezultate

Categorie animal  
 Tineret  Di Gest/Lact  Berbeci

Sex  
 M  F  Castrat

q(=EM/EB) [0..1]  Temp. amb. [grC]

Greutate [kg]  Spor [g]

Virsta:

Activitate Fizica  
 Dist. horiz. [m]   
 Dist. vert. [m]   
 Stat in picioare [h/zi]   
 Schimbari pozitie

Pasune (Stabulatie)

N. Mac.+Conc. (Fibr. nematic.)  Majorare 5%

Rezultate [./zi]

Marime	Valoa...
PDl[g]	1015
EN[MJ]	10.33
---EN[UNL]	1.703
SUMMas[kg]	1.387
CIMas[USO]	0.000
Ca[g]	10.0
P[g]	3.7
Mg[g]	1.0
Na[g]	1.3
S[g]	2.9
PDI <sub>m</sub> [g]	34.8
PDI <sub>w</sub> [g]	21.7
PDI <sub>c</sub> [g]	45.0
PDI <sub>g</sub> [g]	0.0
PDI <sub>l</sub> [g]	0.0
---EN <sub>m</sub> [UNL]	0.475
---EN <sub>w</sub> [UNL]	0.041
---EN <sub>g</sub> [UNL]	0.053
EN <sub>l</sub> [UNL]	1.122

Fig. 2. "Requirement generated by the model" Tab

A printing screen is presented below.

SINGOVIN-01 1.10 - noiembrie 2010 - SIAT Thu, 18.11.2010, 14:40:00

RAPORT NECESAR DE NUTRIENTI - nor\_p1\_palas.ovi

DATE DE START:  
 Genotip:  
 Categorie: Tineret  
 Sex: M  
 Greutate[kg]: 23.00  
 Virsta: Pina la 1 an  
 q(=EM/EB): 0.60

Mediu:  
 Temp. amb.: 15.00  
 Activitate fiz.: Stabulatie  
 Stat in pic. [h/zi]: 14.00  
 Schimbari de poz.: 14  
 Dist. Horiz[m]: 50.00  
 Dist. Vertic[m]: 0.00

Sporuri:  
 Spor [g]: 220.00  
 Tip Nutret: Mac.+Conc.  
 Majorare 5%: NU

REZULTATE:  
 Energie [MJ, UNL/C]:  
 EN<sub>m</sub>: 2.42 0.392  
 EN<sub>dG</sub>: 3.18 0.515  
 EN<sub>w</sub>: 0.25 0.041  
 EN<sub>Q2</sub> (Af): 0.19 0.030  
 EN<sub>l</sub>: 6.03 0.977

Proteine [g]:  
 P<sub>m</sub>: 22.97  
 PDI<sub>dG</sub>: 51.42  
 PDI<sub>w</sub>: 23.21  
 PDI: 97.60

Minerale [g]:  
 Ca: 6.10  
 P: 2.48  
 Mg: 0.67  
 Na: 1.05  
 S: 2.10

Fig. 3. Requirement - printing screen

- A tab for standard requirements, obtained from the standard database;
- A tab for requirements generate by model of Research and Development

Institute for Sheep and Goats Growing- Palas.

For the cases where the calculus is performed using the models the tabs shows the results of the calculus too, so a new tab to display the results is here not necessary.

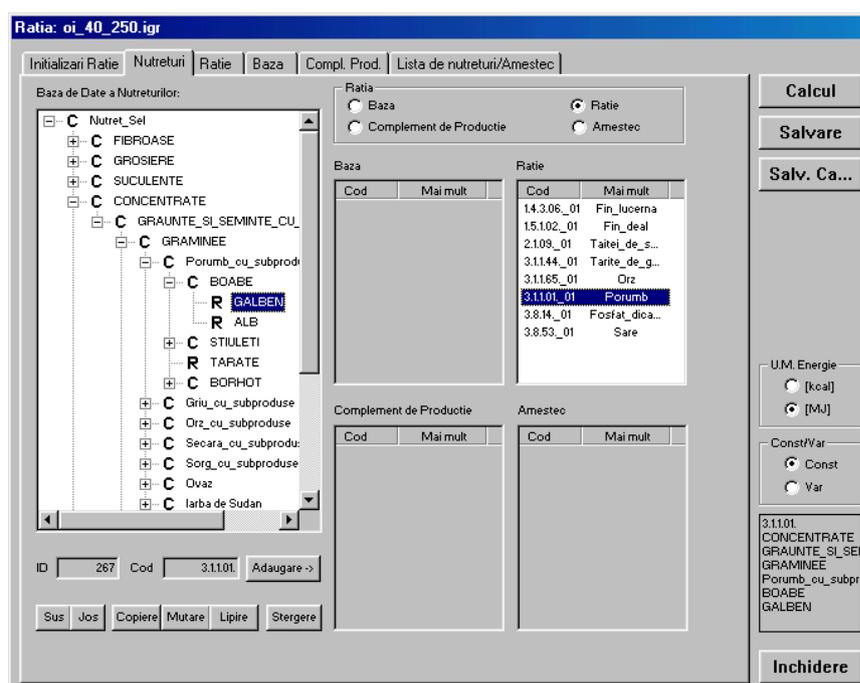
**The module for conception and estimation of the feed ration efficiency** is done by two screens.

The first screen allows the qualitative conception of a ration. It is the only one where this task may be done. In this screen the user sets their daily rations, possibly in three forms. This offers a list for: basic ration, mixed ration and complement production. To prepare mixtures from various ingredient that are included in the ration as the sole ingredient, is used a separate list.

This list is independent and is loaded with ingredients from fooder tree.

For young sheep usually use mixed rations (consisting of forages and concentrate feed) covering production requirements for each productive category.

Mixed rations and that obtained by adding basic rations with production complement should cover the daily requirements for each productive category of young sheep. The similar procedure is used for sheep in gestation and/or lactation.



**Fig. 4. "Ration conception - Feedstuff" Screen**

The second screen operates many data, especially the ration, computed as mentioned above, and the nutritional requirements. It solves a lot tasks, it computes

especially the ration efficiency and shows how the proposed ration is able to comply the nutritional requirements.

The group Ration efficiency shows results.

The screenshot shows the 'Ration' software interface. At the top, there are tabs for 'Initializari Ratie', 'Nutreturi', 'Ratie', 'Baza', 'Compl. Prod.', and 'Lista de nutreturi/Amestec'. The main area contains a table of ingredients with columns for 'Cod', 'SN', '%SN', 'SU', '%SU', 'LInf', 'LSup', and 'Pret'. The selected row is 3.1101\_01. To the right, there are input fields for 'Eficienta ratie: Realizat Necesar [%] Max' and 'Nutrienti limitativi SUIMax'. Below the table is a 'Bilant - Ratie' section with a table showing nutrient levels for various components and a summary table for 'Necesar', 'Ratie', 'Difer.', and 'Raport [%]'. On the right side, there are buttons for 'Calcul', 'Salvare', 'Salv. Ca...', 'U.M. Energie' (with radio buttons for [kcal] and [MJ]), 'Const/Var' (with radio buttons for Const and Var), '3.1101\_01 UTILIZATOR COMPLEMENT Porumb', and 'Inchidere'.

Fig. 5. "Ration" screen

A feed ration printing screen is presented below.

SINGOVIN-01 1.10 - noiembrie 2010 - SIAT-SA Bucuresti Thu, 19.11.2010, 14:43:52

RATIE TINERET OVIN - rt\_pl\_palas\_opt.igr

Greutate curenta [kg]:..... 23 Categoria:.....Tineret Majorare 5%:.....NU  
 Spor [g]:..... 220 Sex:.....Mascul

Cerinta nutritiva						0.988	0.993	97.6	97.6	6.40	2.60		
Valoare nutritiva furaje						Necesar de nutrienti							
SU [kg]	UNL	PDIN [g]	PDIE [g]	Ca [g]	P [g]	SN [kg]	SU [kg]	UNL	PDIN [g]	PDIE [g]	Ca [g]	P [g]	
900.000	0.916	157.5	88.8	18.00	2.00	BAZA IARNA Fin_lucerna	0.200	0.180	0.164	28.3	15.9	3.23	0.36
882.000	1.017	78.5	71.4	2.00	4.00	COMPLEMENT_Orz	0.216	0.190	0.194	15.0	13.6	0.38	0.76
873.000	1.439	84.0	110.3	0.00	3.00	COMPLEMENT_Porumb	0.268	0.234	0.237	19.7	30.5	0.00	0.70
900.000	1.377	328.1	179.6	4.00	8.00	SROT_Soia	0.235	0.211	0.221	69.3	37.9	0.84	1.69
970.000	0.000	0.0	0.0	0.00	0.00	COMPLEMENT_Sarc	0.009	0.008	0.000	0.0	0.0	0.00	0.00
998.000	0.000	0.0	0.0	379.10	0.20	CARBONAT DE CALCIU	0.005	0.005	0.000	0.0	0.0	1.89	0.00
900.000	1.526	63.9	95.8	0.40	2.90	ADITIVL_Zoofort A5	0.002	0.002	0.003	0.1	0.2	0.00	0.00
Ncs. asig. prin ratie						0.830	0.988	132.3	98.1	6.35	3.52		
TOTAL ncs. nutrienti asig.						0.830	0.988	132.3	98.1	6.35	3.52		

Fig. 6. Ration - printing screen

### 3. CONCLUSIONS

The software application SINGOVIN presents a scientific and practical utility. It allows the nutritional characterization from various points of view (energy, protein, amino acids, fat, fatty acids) and takes into consideration the metabolism of the growing and lactating sheep.

The application uses two databases for ingredients, all having the same structure. One database is completely for the user and contains ingredients especially for that user. Ingredient categories and new ingredients can be added within this database and any values of characteristics can be modified.

The nutritional requirements can be estimated for various sheep's category, according to the weight/age, commercial type, environment, housing, physical activity, they are dependent on the desired economic performance (body weight gain, gain quality, milk production).

Nutritional software SINGOVIN is an application intended to be used by nutrition specialists and sheep growing farmers in order to formulate rations for growing and lacting sheep for meat and milk production.

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**FISHERIES MANAGEMENT IN THE CONTEXT OF ROMANIAN SEASIDE  
AREA OF SUSTAINABLE USE OF FISHERIES RESOURCES**

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**Key words:** fisheries, management, resources

**SUMMARY**

Fish and fishing are integral parts of human society and make an important contribution to the socio-economic and welfare in many regions and countries. Fisheries production is used in a wide variety of ways, based on subsistence, trade in fishery products. Despite the enormous importance and value, fisheries resources suffer the combined effect of overexploitation and environmental degradation. Along the Romanian coast, there are several companies that exploit local fisheries. Data from control and monitoring programs have shown that in recent decades, the main catch fish in the Romanian coastal zone mutated severe and often unpredictable. Establishment, application and enforcement of appropriate management measures can lead to sustainable use of fisheries resources in the long term.

**1. MATERIAL AND METHOD**

Qualitative and quantitative composition of fish catches was obtained from fisheries statistics has been achieved by centralizing periods of time and dates from the profile companies and interviews with fishermen. Fishing effort (no. of vessels, no. seines, days of activity) was obtained from company dates and records kept by the National Agency for Fisheries and Aquaculture. The statistical dates used to assess allowable catch exploitable biomass.

Evolution of main species of fish catches in the Romanian marine waters was obtained by centralizing and systematizing in time, catch and effort data obtained from the profile companies. Data analysis was performed for the period 1950-2009. Depending on the status of fish populations, fishing effort applied and the type of tool used, catches the Romanian coast fared better qualitative and quantitative variable structure.

Fishery resource management is an integrated process of information gathering, analysis, planning, consultation, decision making, resource allocation, formulation and implementation of regulations or rules which will govern the fishing activities in order to ensure continuity of resource productivity and return.

**2. RESULTS AND DISCUSSIONS**

Fish and fishing are integral parts of many companies and make an important contribution to the socio-economic and welfare in many regions and countries. Fisheries production is used in a variety of ways, based on subsistence, trade in fishery products. Despite the enormous importance and value, fisheries resources suffer the combined effect of overexploitation and environmental degradation.

Depending on the status of fish populations, fishing effort applied and the type of tool used, catches the Romanian coast had a variable evolution of qualitative and quantitative structure.

In the period 1950-1979 based on the Romanian seaside fishing was done with seines, trap type tools installed perpendicular to the shore, from Sulina and Mangalia. The percentage of high value species like sprat and anchovy catches their constancy explains large fluctuations in annual catch made at the Romanian seaside: from 3.120 tonnes in 1969 to 11.088 tonnes in 1961 (Fig. 1).

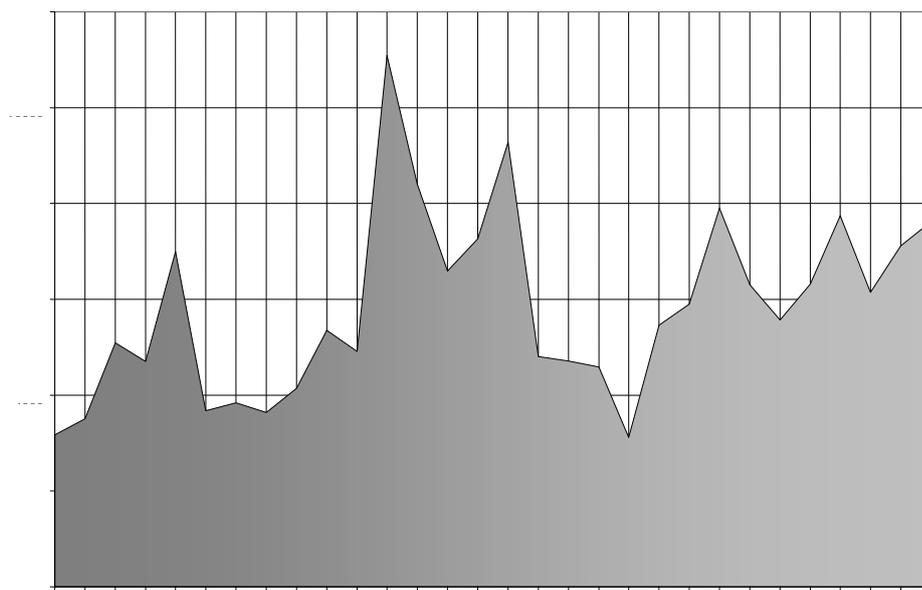


Fig. 1. Total catch (t) made at the Romanian seaside in sea fishing in the period 1950 to 1979

During 1980-2009, a drastic reduction or disappearance of traditional kidnappers Black Sea ecosystem (blue fish, blue mackerel, bonito, dolphin) have determined, on the one hand increase the resources of small pelagic fish (sprat, anchovy, mackerel) that were feeding these predators, and on the other hand increased abundance of predators such as sharks and southern hake.

In the fishing season in the last two decades, made the catch, except the years 1990, 1992, 1993, 1997 and 1998 to 3000-4000 tonnes per year (3582 t/1997, t/1998 3503) was quite low, ranging is between 1200-2500 tonnes (2431 t/1999, 2116 t/2001, 1940 t/2005 respectively t/2006 1390), then declined steeply over the last three years at 435 t / 2007 and 444 t / 2008 and 331 t / 2009.

Responsibility for declining stocks, low profits and employment in fisheries should be divided between: fishermen, fishery management authority, industry scientists and those involved in environmental degradation. Not all problems mentioned are part of the remit of the management, but the fishery manager is right person to observe and

record what happens in fisheries under its jurisdiction, to determine causes of problems, to correct mistakes, to draw attention to stakeholders fishery and those responsible for external causes. There are situations where problems are caused by lack of available information, incomplete understanding of fishery management tasks, inadequate resources, lack of structure and support, use of resources in an efficient way and planned.

It is important to understand that, where resources are overfished or exploited fishery in irresponsible manner in the future will be negative consequences. Fish stocks to levels critical biological and ecological, will cause a loss of potential benefits, especially for food, income, jobs and others, both short and long term.

Responsible management of fisheries management institutions presupposes the existence of which will be part of one or more management authorities.

Area of expertise and resources of fish, fisheries and geographic areas for which management authority is responsible and justified, must be defined with precision.

Sustainable use of marine fishery resources has become a priority of environmental policy, globally recognized and affirmed by all countries by international conventions and agreements. For integrated management of fishery resources must have regard to all environmental - resource - exploitation and appropriate ways of management: *ecological, biological and fishing*.

Currently, fishery resources management is performed independently by each coastal State, taking into account (more or less) in the best condition of living resources in the EEZ (Exclusive Economic Zone) own. Since resources Romanian seaside area is a green single unit must be regional cooperation to maintain and rehabilitate fish populations to levels capable of ensuring sustainable exploitation.

At national level the following general measures should be taken for the management, conservation and resource protection

- the legal provisions on demersal fish in the Romanian seaside,
- development and appropriate financial support of a continuous system of monitoring, control and monitoring of fish population status demersal and pelagic catches and fishing effort;
- protection of fish species with high economic value, by taking drastic measures to stop illegal fishing and prohibit fishing in certain periods of the year;
- special protection areas for breeding, feeding and wintering resources - establishing and technical measures regulate fisheries (areas, times, sizes of species, types of gear, mesh size, etc.), control of fishing effort and total allowable catch (TAC);
- need sizing effort based on the assessment of total allowable catches to prevent overfishing situations - the development of fishing regulations:
- complete regular order of prohibition with measures and recommendations from research;
- establishing and promoting coastal environmental monitoring systems in order to discover as soon as possible degradation of any origin, occurring in the aquatic environment;
- minimizing waste and non-target species, target fish that other species of aquatic organisms by users of aquatic ecosystems and the impact on associated or dependent species;

- habitat protection and development regulations include critical habitat areas Marine protection ;
- protecting habitats and identification of areas in the coastal area to be included in the national network of protected areas;
- education / training fishermen to use correct handling techniques-releasing captured dolphins accidentally in fishing gear and their registration;
- intensifying fisheries control.

In accordance with the Code of Conduct for Responsible Fisheries, fisheries management is the overall purpose of sustainable use of fishery resources in the long term. In achieving this end, proactive approach is needed to optimize the benefits derived from available resources. The first step in the management of active pro fishing, is to decide what we mean by optimizing the benefits for fishermen, or what can the state or group of stakeholders to agree to be benefited to be optimal.

Fisheries management purposes can be differentiated into four groups: biological, ecological, economic and social (including politics and the cultural).

Biological and ecological goals are actually restrictions in achieving desired economic and social benefits. These are:

- maintained at or above the target species need to ensure sustainable productivity (biological) ;
- minimizing the environmental impact of fishing on non-target species and associated or dependent (ecological);
- net income of fishermen participating maximize (economic);
- maximizing opportunities for places work, for those dependent on fisheries (social).

Identifying these goals is important to clarify the use of fishery resources for the benefit of society and agreed goals will be achieved at both central and local levels. Without these purposes fishery will operate uncontrolled, with ad-hoc decisions, resulting in either subexploatarea (loss of benefits), or the appearance of serious conflicts between interest groups, the benefit-sharing.

### 3. CONCLUSIONS

1. For responsible fisheries, fisheries management is the overall purpose of sustainable use of fishery resources in the long term.

2. Achieving this goal requires a proactive approach to optimizing the benefits derived from available resources. This happens rarely, because fisheries management is still practiced as a reactive activity, that decisions and actions are formulated as answers to problems or crises. Decisions are trying to deal with current crisis, without taking into account the broad perspective and long-term objectives. This approach leads to control of dissatisfaction to avoid conflicts, but can not result in the best use of resources in use.

### ACKNOWLEDGEMENTS

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## QUALITY OF SURFACE AND WELL WATER IN TELEORMAN COUNTY

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**Key words:** nutrients, soil structure, surface and well water pollution

### SUMMARY

Surface water quality study and was done well in county Teleorman, saw basin, along the altitude gradient of the river which crosses the county from west to south-east. Localities studied were selected to limit entry, respectively on the river trip limit Teleorman County (Stejaru respectively Bujoru) and the city Plosca is located relative to the middle of the county, is a town with a tradition of gardening and animal husbandry.

From each site were made operational by 6 samples (3 and 3 surface water from wells, during the same month). The three surface water samples were performed in the region of entry of water in the village, a middle region of the water course (mid-village) and the region the river out of town. The determinations made in the study, concentrations of biogenic elements: ammonium, nitrate, nitrite, phosphorus, have been reported to maximum allowable concentrations supported legislation. Nitrite ion concentration of nitrogen in surface water, along the gradient altitude increases, the accompanying trend ammonium ion. The biggest focus of this element is in the sampling points downstream, which means most likely that along the river, it collects and tributaries with organic load. The highest concentration of nitrates in the water fountain was located in the village Plosca, probably because this area is present and historical vegetable in primary and secondary livestock. We recommend close monitoring of the area saw the basin, especially in the localities where they are agro-livestock activities in subsistence farming (animal or vegetable).

### 1. MATERIAL AND METHOD

Mapped the land area is 4.481 ha Stejaru population - 2318 people - in 1245 the number of dwellings. There is no sewage and drinking water. Stejaru territory belongs to the Danube river basin by river Vedea. Land drainage stream is done by collecting water BRATCOV on several valleys of this area and flows into the Vedea.

The state of soil phosphorus supply digestible (P Mobile) - is considered very weak and poorly supplied 24% of the area (1076 ha), middle 26% of the area (1165 ha) and well and very well stocked on 50% of area (2240 ha). The state of soil potassium supply digestible (K cell) - considered middle of the area supplied by 2% (90 ha) and well and very well supplied with potassium on 98% of the area (4391 ha). Nitric natural fertility status - we appreciate the indices of nitrogen and were obtained by correlating the degree of humus content in base saturation is considered low on the 44% of the surface (1972 ha) and East supplied 56% of the surface ( 2509 ha).

Mapped the common land area is 4650 ha Plosca, population - 6810 people. There is no sewage and drinking water. Soil reaction is slightly acid in 91% of the land, natural nitric fertility is low (40% of surface) to moderate (58% of surface), providing average phosphorus is 47% of the territory, being weak and very weak on 27% of the area

and good or very good 36% of the area, and ensure the soil is medium potassium (36%) to very good (36%).

Mapped the common land area is 2527.75 ha Bujoru, population - 1976 population - number of housing 829. There is no sewage and drinking water.

The state of soil phosphorus supply digestible (P Mobile) - is considered low and very low on phosphorus in 5% of the area (128 ha), middle 38% (970 ha) and well and very well supplied with phosphorus 57 % (1429 ha).

The state of soil potassium supply digestible (K cell) - 2% is considered middle (51 ha) and well and very well supplied with potassium in 98% (2476 ha). Nitric natural fertility status - is low by 10% (253 ha) and supplied the middle 30% (758 ha) and well stocked on 60% (1516 ha). The material studied consisted of samples of surface water and wells, taken from the regions described above.

The sampling sites were operational following: Stejaru, Plosca and Bujoru. From each site were made operational by 6 samples (3 and 3 surface water from wells, during the same month). The three surface water samples were performed in the region of entry of water in the village, a middle region of the water course (mid-village) and the region the river out of town.

Regions will be referred to as: upstream, middle and downstream. In the same way it was done to establish sampling points for water fountain. In areas where there were public wells, sampling was done to them. Well water was taken from wells located in the city, near points of surface water sampling.

Water harvesting is the thread where it is deepest, upstream from any influence of any effluent and downstream, where the call is made complete mixing with the effluent receiver.

The determinations made in the study, concentrations of biogenic elements: ammonium, nitrate, nitrite, phosphorus, have been reported to maximum allowable concentrations supported legislation (Law 311/28.06.2004 and Law 458/2002), relating to drinking water fountain and specifications of the Order 161/16.02.2006, on surface water quality. The same acts, the pH should be between 6.5 and 8.5. These concentrations are summarized in Table 2.

*Table 1*

**Maximum allowable concentrations for biogenic elements in surface waters and wells**

Indicator	U.M	Well water	Quality class of surface water			
			I	II	III	IV
N-NH <sub>4</sub>	mg N/l	0.4	0.4	0.8	1.2	3.2
N-NO <sub>2</sub>	mg N/l	10	0.01	0.03	0.06	0.3
N-NO <sub>3</sub>	mg N/l	0,15	1	3	5.6	11.2
P-PO <sub>4</sub>	mg P/l	0,01	0.1	0.2	0.4	0.9

## 2. RESULTS AND DISCUSSIONS

In Tables 2 and 3 are presented the statistical parameters of biogenic elements in the sites analyzed. The largest variation (v%) recorded in samples of surface water analysis of P-PO<sub>4</sub>, this variability being able to test the error, but also the dynamics of concentration of this element along the altitude gradient basin.

Table 2

## Concentrations of biogenic elements statistical parameters of surface water

Specification	Stejaru			Plosca			Bujoru		
	Up stream	middle	downstream	upstream	middle	downstream	upstream	middle	downstream
<b>N-NH<sub>4</sub></b>									
$\bar{X}$	0.803	0.813	0.8400	1.1500	1.026	1.0300	1.4233	1.446	1.4800
$S_g$	0.012	0.012	0.0058	0.0462	0.008	0.0058	0.0240	0.012	0.0058
v%	2.591	2.559	1.1905	6.9565	1.487	0.9709	2.9551	1.438	0.6757
<b>N-NO<sub>2</sub></b>									
$\bar{X}$	0.027	0.027	0.0290	0.0600	0.0600	0.0600	0.0700	0.075	0.0800
$S_g$	0.001	0.001	0.0012	0.0058	0.0058	0.0058	0.0058	0.004	0.0058
v%	7.407	7.407	6.8966	16.6667	16.66	16.6667	14.2857	10.66	12.5000
<b>N-NO<sub>3</sub></b>									
$\bar{X}$	3.100	3.100	3.4000	4.2700	4.200	4.2800	5.1000	5.200	5.6000
$S_g$	0.057	0.057	0.0578	0.0289	0.057	0.0289	0.1155	0.115	0.0577
v%	3.225	3.225	2.9412	1.1710	2.381	1.1682	3.9216	3.846	1.7857
<b>P-PO<sub>4</sub></b>									
$\bar{X}$	0.200	0.250	0.2000	0.2217	0.200	0.2200	0.2300	0.300	0.3000
$S_g$	0.034	0.028	0.0346	0.0088	0.028	0.0115	0.0058	0.057	0.0577
v%	30.00	20.00	30.000	6.8911	25.00	9.0909	4.3478	33.33	33.3333

The data obtained from analysis of samples can be observed that the gradient over the canopy, surface water, ammonium ion concentration of nitrogen increases, and the same trend is observed in the interior towns, meaning that at all points sampling upstream concentrations are lower than those downstream. It is noted that there is an increased concentration of ammonium ion in water fountain, along the altitude gradient, both in the towns and river basin level see. This accumulation is due to continue along the river Vedea fermentable materials (animal manure washed from agricultural land or used as grazing on pastures, water and faeces from household that seeps into the soil, the area is not sewage, fertilizers natural or synthetic fertilizers applied without strict rules and whose strength was not monitored), etc.

Nitrite ion concentration of nitrogen in surface water, along the gradient altitude increases, the accompanying trend ammonium ion. The biggest focus of this element is in

the sampling points downstream, which means most likely that along the river, it collects and tributaries with organic load.

The highest concentration of nitrates in the water fountain was located in the village Plosca, probably because this area is present and historical vegetable in primary and secondary livestock. This requires an intense fertilization of soil throughout the year there are a stock of soil nutrients and water that migrates to the groundwater surface.

Table 3

**Concentrations of biogenic elements statistical parameters of well water**

Specification	Stejaru			Plosca			Bujoru		
	Up stream	middle	downstream		Up stream	middle	downstream		Up stream
<b>N-NH<sub>4</sub></b>									
$\bar{X}$	0.370	0.36	0.3833	0.6000	0.5467	0.6000	0.8700	0.9500	1.0200
$S_{\bar{X}}$	0.011	0.011	0.0441	0.0577	0.0291	0.0577	0.0289	0.0289	0.0058
v%	5.405	5.555	19.924	16.666	9.2071	16.666	5.7471	5.2632	0.9804
<b>N-NO<sub>2</sub></b>									
$\bar{X}$	0.140	0.149	0.1520	0.1890	0.1880	0.1800	0.1440	0.1510	0.1570
$S_{\bar{X}}$	0.011	0.001	0.0006	0.0012	0.0035	0.0058	0.0006	0.0006	0.0012
v%	14.28	1.342	0.6579	1.0582	3.1915	5.5556	0.6944	0.6623	1.2739
<b>N-NO<sub>3</sub></b>									
$\bar{X}$	9.700	9.700	9.9000	10.8000	10.5000	10.8000	10.0000	10.5000	10.8000
$S_{\bar{X}}$	0.115	0.115	0.1154	0.2309	0.3464	0.2309	0.2887	0.1155	0.0577
v%	2.061	2.061	2.0202	3.7037	5.7143	3.7037	5.0000	1.9048	0.9259
<b>P-PO<sub>4</sub></b>									
$\bar{X}$	0.000	0.010	0.0000	0.0200	0.0200	0.0240	0.0210	0.0250	0.0250
$S_{\bar{X}}$	0.000	0.000	0.0000	0.0029	0.0029	0.0012	0.0012	0.0012	0.0012
v%	0.000	0.000	0.0000	25.000	25.000	8.3333	9.5238	8.0000	8.0000

Nitrates - ammonia and nitrates concomitant presence shows continuous pollution and inadequate disinfection. Small amounts of nitrates can be found in almost all waters.

Testing the significance of differences between sites in terms of concentration of key nutrients in the two studied compartments (surface water and well water) was determined by reference to an experimental plan, based on a model with one factor; the factor whose significance is testing is the site. These differences were tested separately on the three levels / gradients sampling (upstream, middle and downstream), by the Student test.

Table 4

**Tabular t values to determine significance of differences**

Specification GL=4	Significant level		
	0.05	0.01	0.001
t tabular	2.776	4.604	8.610
Note	*	**	***

Student test of calculated values for testing significance of differences in the concentration of ammonia nitrogen in the sites analyzed, we see that are highly

significant differences between localities along the altitude gradient, increasing the concentration of this element, as its river follows to spill into the Danube ( $t = 23.07$ ,  $\alpha = 0.001$  between Bujoru –Stejaru, upstream and  $t = 14.31$ ,  $\alpha = 0.001$  between Stejaru and Plosca,  $t = 37.26$ ,  $\alpha = 0.001$  between Stejaru and Bujoru and  $t = 28.17$ ,  $\alpha = 0.001$ , middle,  $t = 23.27$ ,  $\alpha = 0.001$  between Stejaru and Plosca,  $t = 78.38$ ,  $\alpha = 0.001$  between Stejaru-Bujoru and  $t = 55.11$ ,  $\alpha = 0.001$  between Plosca and Bujoru, downstream).

Significant differences are recorded separately from neighboring localities Stejaru and Plosca, upstream ( $t = 7.26$ ,  $\alpha = 0.01$ ) and between Plosca and samples Bujoru in the middle ( $t = 5.24$ ,  $\alpha = 0.01$ ). This phenomenon is due on the one hand, historical pollution from agriculture (due to excessive fertilizării) and on the other hand, diffuses pollution and continues today.

Student statistics values for concentrations of nitric shows highly significant differences in the concentration of these elements in samples taken from the Bujoru-Stejaru and, for all altitude gradient ( $t = 7.3$  upstream, middle  $t = 10.08$  and  $t = 8.66$  downstream,  $\alpha = 0.01$ ) and significantly distinct differences for the couple Stejaru-Plosca ( $t = 5.6$  in the upstream, downstream  $t = 5.2$ ,  $t = 5.6$   $\alpha = 0.01$ , in middle) for all sampling points.

This is due to fermentable organic matter input from the village flasks, agricultural region, vegetable and livestock, with many individual households are raising animals, gardening and agriculture is, contrary to the rules of environmental protection plans fertilizer or manure management.

The calculated values of Student test for testing significance of differences in the nitrate nitrogen concentration shows distinct differences between flasks and Bujoru significant ( $t \geq 6.97$ ,  $\alpha = 0.01$ ), for samples collected upstream and means, and for downstream samples, as for the couple Stejaru-flasks ( $t \geq 13.47$ ,  $\alpha = 0.001$ ), the differences are highly significant.

Corroborating these data with those of nitrite, we see that there is a major risk of pollution of surface waters with nitrates and nitrites and the risk of groundwater pollution is high. It is possible that along the altitude gradient, self-cleaning ability of water and biogenic elements by the consumption of aquatic organisms has a lower rate than production and supply of these biogeochemical elements of the circuit, hence the fact and excess nutrients.

Focus on ammoniac nitrogen in water well, testing the significance of differences between neighboring towns is noted that significant differences for couples Stejaru-Plosca ( $t = 3.9$ ,  $\alpha = 0.05$ ) and Plosca, Bujoru ( $t = 4.18$ ,  $\alpha = 0.05$ ), as the concentration of this element in wells upstream localities in the middle and downstream are very significant differences ( $t \geq 5.96$ ,  $\alpha = 0.01$ ), and the couple Stejaru-Bujoru differences are highly significant ( $t \geq 9.84$ ,  $\alpha = 0.001$ ), for all sampling points.

Student statistics for the calculated values for N-NO<sub>3</sub> between sites comparisons of well water shows significant differences between Plosca and Stejaru upstream ( $t = 4.26$ ,  $\alpha = 0.05$ ) and downstream ( $t = 3.48$ ,  $\alpha = 0.05$ ) and significant differences between Stejaru and Bujoru, the village center ( $t = 10.68$ ,  $\alpha = 0.01$ ) and downstream ( $t = 6.97$ ,  $\alpha = 0.01$ ). Highly significant differences ( $t \geq 10.53$ ,  $\alpha = 0.001$ ), the torque-Bujoru Stejaru upstream Stejaru-Plosca and Plosca-Bujoru, downstream.

These differences lead us to conclude that the well water from Plosca is rich in nitrates than in the localities examined, and groundwater is self-cleaning capacity and decrease the concentration of nitrites, since the Bujoru, the concentration of this element in well water drops.

### 3. CONCLUSIONS

Nitrates comes of these sources of pollution: fertilizer used in large amounts in intensive agriculture, pesticides with nitrogen fertilizers storage places damaged or built too close to private wells. Drinking water with high content of nitrates may cause methemoglobinemy, which are particularly affected children of 0-1 years, especially those fed artificially, cause cancer of the esophagus, stomach, liver, intestines, colon, bladder and increases impotence in men.

Nitrate concentration of well water is significantly different between Stejaru and flasks upstream and downstream and distinct from Stejaru and Bujoru significant in samples of middle and downstream communities. This is due, on one hand the integration of natural biogeochemical cycle of this element, and secondly to reduce nitrates to nitrites. In addition, the presence of these biogenic elements in surface water in concentrations exceeding maximum allowable concentrations, lead to increases of the risk of surface water pollution by eutrophication.

We recommend close monitoring of the area saw the basin, especially in the localities where they are agro-livestock activities in subsistence farming (animal or vegetable). It would also be welcome training population in terms of waterborne disease risk, emphasizing prevention and treatment methods. One of the easiest solutions would be to introduce water sanitation and well prohibit drinking.

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**RESEARCHES REGARDING THE OPTIMIZATION OF SOME  
NUTRITIONAL FACTORS TO IMPROVEMENT OF THE DIETETIC  
QUALITY OF LAMBS**

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**Key words:** linoleic acid, linolenic acid, muscle tissue, lambs, biohydrogenation

**SUMMARY**

Modern human nutrition promotes the reduction or total exclusion of food involved in diseases of the century, which leads to the involvement of researchers in a series of experiments that aim at obtaining food beneficial to human health. The meat lambs, an important source of energy and animal protein, contains fractions of saturated fat that lead to a limited consumption by humans. It is generally accepted that the fatty acid composition of lambs meat depends on the composition of dietary fat, the duration of the feeding treatment, the genetic type and the live weight at slaughter. In many cases, animals diets are supplemented with vegetable oils containing a high percentage of unsaturated fatty acids, favoring the production of healthy meat for consumer. Knowing that biohydrogenation of dietary polyunsaturated fatty acids (PUFA) by ruminal microorganisms (Doreau and Ferlay, 1994), beef and lamb fat tends to contain more saturated fatty acids (SFA) than non-ruminant fat. In our coming experience we try to find which is most recommended method to chance the fatty acids profile in meat lambs.

**1. MATERIAL AND METHOD**

In the our coming experiment, biological material was represented by a total of 15<sup>th</sup> lambs belonging to Tigaie de Teleorman, lambs aged 2 months, which were distributed in 3 experimental groups. They were housed in individual pens and fed with compound feed once daily in the morning and had free access to clean drinking water. The lambs were fed with alfalafa hay and a special compound feed were introduced camelina seeds in two forms: chemically treated seeds with an NaOH solution and untreated seeds. The NaOH treatment was follows: for 100 kg camelina seeds was added 10 l NaOH and 25 l water and after were mixed for 45<sup>th</sup> min. After removal from the mixer, treated seeds were spread on a concrete floor. The seeds were mixed by hand at regular intervals. After reaching ambient temperature the seeds were transferred to storage before preparation of the compound feed. Three experimental rations were prepared that differed in source of fat used. All rations wre formulated to be isoenergetic and isoproteic. The animals were slaughtered after 45<sup>th</sup> days on the experimental rations. After slaughter, the weight of the carcass, kidneys, liver and perireneal fat depot were recorded. Samples for fatty acid analysis and meat composition were vacuum-packed and stored frozen at -30°C.

The formulation of the rations which have been used is to be found in table 1.

Table 1

**The formulation of experimental rations**

<b>Ingredients (%)</b>	<b>Control Lot (C)</b>	<b>The first Experimental Lot (E1)</b>	<b>The second experimental Lot (E2)</b>
Barley	50	40	40
Mais	27	27	27
Soyabean meal	20	20	20
Mineral and vitamin mix	3	3	3
Camelina seeds	-	<b>10</b>	-
Camelina seeds/NaOH	-	-	<b>10</b>

The experimental protocol is presented in table 2.

Table 2

**The experimental protocol**

<b>Lots</b>	<b>Treatment applied</b>	<b>The amount of food administrated</b>
<b>Control lot (C)</b>	alfalafa hay + Simple compound feed	<b>Beginning of experiment</b> 1kg Alfalfa hay+0,3 Kg compound feed <b>After 21<sup>st</sup> days from the beginning</b> 1kg Alfalfa hay+0,5 Kg compound feed <b>After 45<sup>th</sup> days from the beginning</b> 1kg Alfalfa hay+1 Kg compound feed
<b>The first Experimental Lot (E1)</b>	alfalafa hay +camelina seeds	
<b>The second experimental Lot (E2)</b>	alfalafa hay +camelina seeds/NaOH	
<b>The objectives of experiment</b>		
Content analysis in fatty acids of camelina seeds and camelina treated seeds Content analysis in fatty acids of obtained meat		

## 2. RESULTS AND DISCUSSIONS

The fatty acid composition of the fat sources before mixing with the other ingredients is summarized in Table 3. The trend in the data was for NaOH treatment to increase the proportion of individual and total saturated fatty acids and to decrease the proportion of C18:3n-3 and total unsaturated fatty acids.

Table 3

**Fatty acids composition of camelina treated or untreated seeds**

Fatty acid	Camelina seeds	Camelina seeds/NaOH
	g/100g fatty acid methyl esters	
C14:0	0,13	0,2
C16:0	6,75	9,3
C16:1	0,00	0,5
C18:0	2,21	4,0
C18:2n-6	17,3	21,2
C18:3n-3	39,5	28,8
C22:1	3,96	2,8
Sum of Saturated fatty acids	9,90	13,5
Sum of Unsaturated fatty acids	60,76	53,3

It is easy to observe that camelina seeds treated has the highest concentration of linoleic acid (C18:2n-6), respectively 21,2 % compare with only 17,3% in case of camelina untreated seeds. High concentration of linolenic acid (C18:3n-3) (39,5%) is to be found in camelina untreated seeds. The unsaturated/saturated fatty acids report in camelina treated or untreated seeds is presented in table 4.

Table 4

**The unsaturated/saturated fatty acids report in fat sources**

Fatty acids	Camelina untreated seeds	Camelina treated seeds/NaOH
Unsaturated fatty acids	60,76	53,3
Saturated fatty acids	9,90	13,5
UFA:SFA	6,13	3,94

Considering the initial live weight and the final live weight was possible to measure the effects of dietary fat sources on the performances: weight gain and daily weight gain during the experiment (table 5) and carcass weight (table 6).

Table 5

**The effects of dietary fat source on the performances and carcass weight**

Diet	Control	Camelina untreated seeds	Camelina treated seeds/NaOH	Statistical significance of effect
Initial live weight (kg)	18,5±0,956	18,2±0,875	18,6±0,934	NS
Final live weight (kg)	28,9±1,013	29,1±0,988	30,1±1,213	NS
Weight gain during the experiment (kg)	10,4	10,9	11,5	NS
Daily gain during the experiment (g/day)	231±8,68	242±10,003	255±9,909	NS

When compared with lambs offered the control diet, the inclusion of camelina seeds increased the daily live weight gain, but the differences are not significant.

Table 6

**The effects of dietary fat source on the carcass weight**

Diet	Control	Camelina untreated seeds	Camelina treated seeds/NaOH	Statistical significance of effect
<b>Hot carcass (kg)</b>	12,5	12,8	13,5	NS
<b>Cold carcass (kg)</b>	12,2	12,0	12,9	NS
<b>24h muscle pH</b>	5,8	5,6	5,7	NS
<b>Carcass structure</b>				
<b>Bone(%)</b>	24,6	25,1	24,8	NS
<b>Lean(%)</b>	59,0	58,2	58,5	NS
<b>Subcutaneous fat(%)</b>	7,4	8,1	8,3	*
<b>Intermuscular fat (%)</b>	9,0	8,6	8,4	NS

Slaughter weight was lower in lambs fed the control diet, although there was no significant effect of dietary treatment on carcass weight (kg). Camelina untreated lambs were observed to have a lower carcass weight than lambs from either of the other two breeds (mean cold carcass weights). The content of lean was lower in lambs fed with camelina untreated seeds (58,2%) than those of either of the other two breeds. By contrast, %subcutaneous fat was significantly lower in control lambs.

However, the main objective of the experiment was to obtain lambs meat enriched in unsaturated fatty acids not heavier weights of carcass. Sheep meat is characterized as being high in saturated fatty acids and low in unsaturated fatty acids, attributes that are regarded as being disadvantageous within the human diet.

The fatty acid composition of the meat obtained from the lambs involved in experiments is summarized in Table 7.

Table 7

**Fatty acids composition of total intramuscular fat from longissimus dorsi**

Fatty acid	Control	Camelina seeds	Camelina seeds/NaOH
	g/100g sample		
C12:0	<b>0,07</b>	<b>0,08</b>	<b>0,05</b>
C14:0	<b>1,55</b>	<b>1,84</b>	<b>1,68</b>
C14:1	<b>0,04</b>	<b>0,12</b>	<b>0,09</b>
C15:0	<b>0,44</b>	<b>0,23</b>	<b>0,31</b>
C16:0	<b>24,42</b>	<b>23,98</b>	<b>22,82</b>
C16:1	<b>1,98</b>	<b>1,88</b>	<b>1,34</b>
C17:0	<b>1,58</b>	<b>1,45</b>	<b>1,32</b>
C17:1	<b>0,31</b>	<b>0,53</b>	<b>0,49</b>
C18:0	<b>16,05</b>	<b>16,79</b>	<b>15,67</b>
C18:1	<b>39,23</b>	<b>36,45</b>	<b>37,10</b>
C18:2n-6	<b>2,21</b>	<b>2,30</b>	<b>3,06</b>
C18:3n-3	<b>1,04</b>	<b>1,56</b>	<b>1,78</b>

C18:3n-6	<b>0,01</b>	<b>0,09</b>	<b>0,18</b>
C20:4n-6	<b>0,09</b>	<b>0,13</b>	<b>0,42</b>
C22:6n-3	<b>0,02</b>	<b>0,02</b>	<b>0,05</b>
Sum of <b>Saturated fatty acids</b>	<b>44,11</b>	<b>44,41</b>	<b>41,85</b>
Sum of <b>Monosaturated fatty acids</b>	<b>41,25</b>	<b>39,07</b>	<b>39,02</b>
Sum of <b>Polyunsaturated fatty acids</b>	<b>3,68</b>	<b>4,1</b>	<b>5,49</b>

Following analysis of data from table 7, we can notice the increase of polyunsaturated fatty acids in the fat obtained from lambs fed with camelina treated seeds (5,49 g/100g sample comparatively with 3,68 g/100g sample at the control lot and 4,1 g/100g sample for lambs fed with camelina untreated seeds). This result was possible only because the dietary polyunsaturated fatty acids was protect from biohydrogenation. Same results were obtained by Sinclair L.A., 2007-“Substantial improvements in the P:S ratio up to 0,57 and increases in muscle and adipose tissue levels of 18:3n-3 of up to 4g/100 g fatty acids can be obtained, but rely on protecting PUFA from biohydrogenation.

Total lipid from lambs fed the camelina seeds/NaOH had a higher proportion of C18:2n6, C18:3n-3, C18:3n-6, C20:4n-6, C22:6n-3. The difference was greater between camelina seeds/NaOH and control lot than between camelina treated seeds and camelina untreated seeds. We can notice also, that the increase in rations oilseeds untreated, does not affect the proportion of saturated fatty acids (44,41 g/100g sample- E1 and 44,11 g/100g sample -C). Camelina seeds/NaOH introduced into dietary lead to obtain higher proportion of very long chain polyunsaturated fatty acids.

### 3.CONCLUSIONS

- camelina seeds treated has the highest concentration of linoleic acid (C18:2n-6), respectively 21,2 % compare with only 17,3% in case of camelina untreated seeds;
- high concentration of linolenic acid (C18:3n-3) (39,5%) is to be found in camelina untreated seeds;
- the content of lean was lower in lambs fed with camelina untreated seeds (58,2%) than those of either of the other two breeds;
- the increase of polyunsaturated fatty acids in the fat obtained from lambs fed with camelina treated seeds, only because the dietary polyunsaturated fatty acids was protect from biohydrogenation;
- total lipid from lambs fed the camelina seeds/NaOH had a higher proportion of C18:2n6, C18:3n-3, C18:3n-6, C20:4n-6, C22:6n-3;
- the increase in rations oilseeds untreated, does not affect the proportion of saturated fatty acids (44,41 g/100g sample- E1 and 44,11 g/100g sample -C)

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**RESEARCHES REGARDING THE INFLUENCE OF THE STRUCTURE OF THE RATIO AND OF THE PROTEIN LEVEL UPON THE WEIGHT INCREASE AND THE QUALITY OF CARCASSES AND MEAT AT THE LAMBS THAT ARE BEING FATTENED**

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**Key words:** protein level, weight increasing rate, quality of carcass

**SUMMARY**

The experiment aimed the influence of 2 protein levels (PDI) – 12 % and respectively 14% of Dry Substance (DS) – in certain fodder recipes with high quantities of concentrated fodders used at the intensive fattening of lambs. It was also aimed the weight increasing rate, the conversion of fodders in increasing rate and the tissue composition of the carcasses. It was revealed the influence of the high level of protein upon the decrease of the fat rate in the carcass.

**1. MATERIAL AND METHOD**

The experiment was developed at the Institute of Research – Development for Sheep and Goat Breeding - Constanța on 4 lots of weaned male lambs of 17 animals each belonging to Palas Merino breed and Meat line of Palas.

The maintenance of the 4 lots was made in an open stable, arranged in boxes and all necessary utilities.

For each of the 2 breeds there were organized 2 homogenous and analogue lots regarding the age and body weight. The fattening of lambs lasted 87 days, period during which the same fodder recipes were assured.

The lambs from all experimental lots were weighted in the beginning of the experiment and in the end of the fattening period, determining the weight increasing rate, the consumption of fodders and nutritive substances, conversion of fodders in weight increasing rate and the analysis of certain quality indicators of the carcasses and of meat.

The experiment aimed the influence of 2 levels of protein – 12% and 14% from DS of the ratio in the conditions of assuring a high energetic level of the ratio: 100-105 UNC% of DS.

The fodder recipes were made according to table 1.

The rate of fiber fodders was of 22% gave the protein level of the ratio that gave the protein level of 12% and of 17% at the lot that gave the protein level of 14% from DS.

The concentrated fodders were 73% at ratio 1 and 78% at ratio 2.

The fodder ratios were made periodically, the given fodders and the non-consumed rests being weighted daily.

In the end of the experimental period experimental slaughtering were made, 4 animals from each lot. Before slaughtering the lambs were hair-cut and put on a diet of 24h.

Table 1

**The structure and the nutritive value of the ratios used at fattening**

Fodder (%)	ratio 1	ratio 2
Lucerne hay	22	17
Barley beans	24	18
Corn beans	24	30
Soybean meal	25	30
Salt	2,8	2,8
Chalk	2	2
PVM	0,2	0,2
<b>Total</b>	<b>100</b>	<b>100</b>
Nutritive value (% of DS)		
Energy (UNC)	100	105
PDI	12	14

After slaughtering the carcasses were refrigerated at a temperature of 2-5<sup>0</sup>C for 24 h.

After weighing, the carcasses were sectioned in 2 halves, and the right half was portioned in 3 regions – shoulder, mutton's leg and the rest of the carcass which were subject to dissection in order to determine the tissue composition.

There were determined 2 values of the slaughtering output:

- output 1 – by making the proportion of the weight of the cooled carcass to the living weight;
- output 2 – by making the proportion of the cooled weight to the empty living weight (the difference between the living weight and the weight of the content from pre-stomachs, stomach and intestines)

To determine the quality indicators of the meat samples from Longissimus Dorsi muscle were gathered and they were analyzed in the laboratory.

All the obtained data were processed and statistically interpreted.

## 2. RESULTS AND DISCUSSIONS

In the specialty literature there are very various data about the protein level of the fodder recipes that contain high quantities of concentrated fodders used in fattening of lambs. The achievement of certain adequate ingestions of azoth in relation to the ingestion of energy is crucial for optimizing the increase of weight and quality of the obtained carcasses.

The results obtained in our experiment regarding the weight increase are presented in table 2.

Table 2

**The increase of weight of the lambs during fattening period**

Breed	Fodder ratio	Initial weight (kg)	Final weight (kg)	Total increasing rate (kg)	Average daily gain (g)
		$\bar{X} \pm s_x$	$\bar{X} \pm s_x$	$\bar{X} \pm s_x$	$\bar{X} \pm s_x$
Palas Merino	Ratio 1 (12% PDI)	18,12±0,8082	33,41±1,6420	15,28±1,1990	175,56±13,78
	Ratio 2 (14% PDI)	17,77±0,406	34,37±1,284	16,62±1,1435	190,73±13,1589
Meat Line of Palas	Ratio 1 (12% PDI)	22,00±1,3957	37,91±1,814	15,906±1,887	182,75±13,6713
	Ratio 2 (14% PDI)	23,1±1,1984	42,23±1,3495	19,133±1,1746	219,87±13,5094

**Note:** There were not significant differences statistically significant between the 2 protein levels at each breed. (Fisher Test  $p > 0,05$ ).

From the obtained data it resulted that the lambs of Merino breed achieved weight increasing rates between 175,56±13,789 g and 190,73±13,1589 g, and the lambs from the Meat Line of Palas breed achieved 219,867±13,509 g and 182,75±13,6713 g, which did not present significant differences between the 2 breeds and nor between the 2 ratios with different protein levels administrated to each population.

It was not observed a significant effect of the protein level of the ratio upon the performances of lambs' growing at all the lambs from Palas Merino breed and at those from the Meat Line of Palas, registering a little advantage for the weight increasing rate in the conditions of administering a higher protein level.

The data obtained by us regarding the weight increasing rate are a lot under the value of certain previous data obtained for the lambs from Palas Merino breed which, in the conditions of assuring protein levels of 8,5-14,5% achieved average daily increasing rates of 277-300 g, while assuring an energetic level of the ratios of 2500, 2700 kcal/kg combined fodder (Călătoiu A. and colab., 1975).

These results could suggest the fact that the transformations occurred at Palas Merino breed, respectively, the drastic diminution of the effectives and the lack of selection for the meat production affected also the productive performances of the breed in this direction. However, recent studies made by Vicovan G. and collaborators (2009) revealed the fact that at a similar level of feeding (14,6% PBD and 97,4% UNC), the lambs of Merinos de Palas breed made an average daily weight increasing rate of 259,71±10,4647 g, and those from the Meat Line of Palas of 268,96±8,7466 g.

Through the increase of the protein level of the ratios we would have expected this to influence the weight increasing rate, but the results obtained in the present experiment are under the potential of the 2 breeds. This could be the result of the high temperatures (36-38<sup>0</sup>) registered during the fattening period which influenced the ingestion of fodders and nutritive substances and thus the breeding performances of the lambs.

Regarding the influence of the protein level of the ratio upon the breeding performances we can mention the fact that there are authors (Zundt ş.a., 2002) who show that in the diets used to fatten the hybrid lambs that contain 70% concentrated fodders there is a linear relationship between the protein level and the increasing rate, while other authors as Beauchemin a.o. (1995) studying diets with 15 and 18% raw protein did not observe differences between treatments, suggesting that the energetic level of the ratios is more important than the assured source of protein and its level in the ratio.

In another paperwork of Ruiz Nuno and collaborators (2009) where it was studied the effect in fattening the lambs of three fodder ratios containing protein levels of 14, 16 and 18% from the dry substance it is concluded that the results did not present significant differences.

The study of the consumption of the ratios did not reveal significant differences between lots (table 3).

The daily ingestion of dry substance was similar at the 4 lots, not emphasizing an influence of the protein level or of the breed upon this parameter. The daily ingestion of dry substance was of 0,99-1,05 kg at the lambs from Palas Merino breed and 1,088-1,089 kg at the lambs from Meat Line of Palas.

There are studies which do not report an effect of the increase of the protein level upon the daily ingestion of dry substance (Beauchemin ş.a., 1995, Zundt ş.a., 2002).

Table 3

**Daily ingestion of dry substance and the conversion of fodders into increasing rate**

Specification	UM	Palas Merino		Meat Line of Palas	
		Ratio 1	Ratio 2	Ratio 1	Ratio 2
Ingestion of Dry Substance /animal/day	kg	1,05	0,990	1,088	1,089
DS/kg increasing rate	kg	5,98	5,19	5,95	4,95
Energy/ kg spor	UNC	5,98	5,19	6,24	4,95
Protein/kg increasing rate	g	797	618	831	591
Concentrate/kg increasing rate	kg	4,67	4,35	5,36	4,16

In another paperwork referring to the weigh increase and the conversion of fodders into increasing rate A.Purroy and collaborators (1995) show that in the case of fattening the lambs from Aragon breed with ratios of protein levels of 12-18%, the animals fed with lower protein levels consumed significantly fewer fodders.

The obtained data regarding the conversion of fodders and nutritive substances into weight increase shows the fact that this was influenced by the protein level of the ratios and the weight increasing rate.

The specific consumption of dry substance was of 5,19-5,98 kg at the lambs from Palas Merino breed and of 4,95-5,95 kg at the lambs from Meat Line of Palas

The obtained results regarding the specific consumption of nutritive substances nutritive reveals the fact that the most efficient conversion of the fodders into weight

increasing rate was achieved at the Meat Line of Palas which received the ratio with a protein level of 12%. This was of 4,95 kg dry substance, 4,95 UNC, 591 g PDI and 4,16 kg concentrated fodders.

The obtained results regarding the experimental slaughtering (table 4) revealed the fact that the value of the slaughtering output at the living weight ( $R_1$ ) was higher at the lambs from Meat Line of Palas comparatively to Palas Merino breed, with 5,16% in the case of the protein level of 14% and with 9,49% in the case of using the recipe with 12% protein.

Table 4

**The slaughtering output at the lots of fattening lambs depending on the protein level**

Specification	Breed	Living weight (kg)	Empty living weight (kg)	Weight of cooled carcass (kg)	Output (%)	
					$R_1$	$R_2$
Low protein level	Palas Merino	39,67	36,33	18,78	47,30	51,65
	Meat Line of Palas	40,33	37,00	20,24	51,79	54,70
High protein level	Palas Merino	40,67	37,29	19,08	46,91	51,16
	Meat Line of Palas	41,50	37,97	20,48	49,33	53,92

**Note:** There were not significant differences statistically between the 2 protein levels at the two genotypes. (Fisher Test  $p > 0,05$ ).

In the case of the high protein level the slaughtering output was of 49,33% at the Meat Line of Palas and 46,91% at the lambs from Palas Merino breed.

In the case of using the ratio with low protein level the slaughtering output was of 51,79% at the Meat Line of Palas and 47,30% at Palas Merino breed.

The slaughtering output calculated at the empty living weight was of 53,92% (Meat Line of Palas) and respectively 51,16% (Palas Merino) at the ratio with the protein level of 14% and of 54,70% (Meat Line of Palas), respectively 51,65% (Palas Merino) in the case of using low protein level.

The analysis in each breed of the slaughtering output in relationship with the protein level of the used ratios in the lambs' food revealed the fact that both at Palas Merino breed and at the Meat Line of Palas, the output did not present significant differences ( $p > 0,05$ ) between the 2 protein levels of the ratios.

To determine the tissue composition of the carcasses, after cutting the carcasses in the three regions (shoulders, mutton's leg, the rest of the carcass), each anatomic piece was dissected, separating the muscles, covering and intramuscular fat and bones, all these being weighted with an electronic balance with a precision of  $\pm 5$  grams.

The proportion of the three regions in the carcass at the lambs of Palas Merino breed and Meat Line of Palas depending on the used fodder ratios is presented in table 5.

Table 5

**The rate of the anatomic regions that resulted from the cutting of the carcasses depending on the protein level and breed**

Specification	Breed	The rate of the cut pieces (%)		
		Mutton's leg	Shoulders	Rest of carcass
Low protein level	Palas Merino	32,06	19,25	48,69
	Meat line of Palas	32,65	19,47	47,80
High protein level	Palas Merino	31,32	19,78	48,88
	Meat line of Palas	33,00	19,97	47,02

**Note:** There were not emphasized differences statistically between the 2 protein levels in each breed. (Fisher Test  $p > 0,05$ ).

From the obtained data it was revealed the fact that the rate of the 3 anatomic regions was not influenced by the assured protein level in the ratio at none of the 2 populations. The rate of the mutton's leg was of 31,32% and respectively 32,06% at the lambs from Palas Merino breed and 32,65% and respectively 33% at the Meat Line of Palas. The shoulders had a proportion of 19,25% and respectively 19,78% at the Palas Merino breed and 19,47% and respectively 19,97% at the Meat Line of Palas.

The results regarding the tissue composition of the carcasses at the lambs of Palas Merino (table 6) reveals the fact that the 2 protein levels did not influence significantly the rate of muscular and bones tissue in the carcass. The rate of the muscular tissue was of 62,13-63,16%, and of the bones was of 22,99-23,90%.

Table 6

**The tissue structure of the carcass depending on the protein level of the ratio at Palas Merino breed**

Specification	Weight of semi-carcass (g)	UM	Muscles	Bones	Fat	Meat*
	X ± sx		X ± sx	X ± sx	X ± sx	X ± sx
High protein level	9350,0 ± 254,4766	g	5901,67 ± 91,3480	2238 ± 52,3480	1191,67 ± 52,9413	7093,30 ± 139,4135
		%	63,16	23,90	12,73	75,89
Low protein level	9180,00 ± 441,3615	g	5701,67 ± 253,6621	2113,30 ± 126,5021	1346,67 ± 62,7400	7048,33 ± 313,9843
		%	62,13	22,99	14,67	76,80
Differences ± percent points between the high and low levels and significance of differences (Fisher Test)			+ 1,03 p > 0,05 NS**	+ 0,91 p > 0,05 NS**	- 1,94 p < 0,05 S**	- 0,91 p > 0,05 NS**

**Note:** \* The meat is consisted of the muscle groups taken together with the intramuscular and covering fat.

\*\*NS nonsignificantly; S significantly.

The rate of fat in the carcass was between 12,73% and 14,67%.

The quantity of covering and intramuscular fat was bigger with 13,01% at the lot fed with the fodder ratio with protein level of 12% comparatively to the protein level of 14%, the differences being significant ( $p < 0,05$ ).

The meat had a proportion of 75,89-76,80%, and differences statistically significant did not exist between the two protein levels.

The muscle/bones proportion was of 2,6-2,7/1, and the meat/bones proportion was between 3,2/1 and 3,3/1.

The tissue composition of the carcass at the lambs from the Meat Line of Palas (table 7) revealed the fact that also at this genotype the protein level of the fodder ratios used for fattening the lambs did not significantly influenced the rate of muscular and bones tissue which were 63,67-65,38% and respectively 21,24-22,46%.

Table 7

**The tissue structure of the carcass depending on the protein level of the ratio at the Meat Line of Palas**

Specification	Weight of semi-carcass (g)	UM	Muscles	Bones	Fat	Meat*
	X ± sx		X ± sx	X ± sx	X ± sx	X ± sx
1	2	3	4	5	6	7
High protein level	10093,30 ± 295,8932	g	6605,0 ± 301,19933	2236,30 ± 7,2649	1206,67 ± 50,8538	7811,67 ± 298,6404
		%	65,38	22,46	11,97	77,35
Low protein level	9928,30 ± 122,7577	g	6351,67 ± 54,1859	2110,0 ± 66,5833	1443,30 ± 111,4052	7795,0 ± 57,9511
		%	63,67	21,24	14,51	78,53
Differences ± percent points between the high and low levels and significance of differences (Fisher Test)			+ 1,71 p > 0,05 NS**	+ 1,22 p > 0,05 NS**	- 2,54 p < 0,05 S**	- 1,18 p > 0,05 NS**

**Note:** \* The meat is consisted of the muscle groups taken together with the intramuscular and covering fat.

\*\*NS nonsignificantly; S significantly.

The rate of fat in the carcass was bigger at the ratio with lower protein level, respectively 14,51% besides 11,97% at the higher protein level, the existent differences for the adipose tissue being statistically significant ( $p < 0,05$ ).

The rate of fat in the carcass was of 77,35-78,53%, the differences between lots being insignificant ( $p < 0,05$ ).

The muscles/bones and meat/bones proportions had values of 2,9-3/1 and respectively 3,5-3,7/1, being similar between the 2 protein levels.

As a result of the determinations on the samples of Longissimus Dorsi muscle, gathered from all the experimental variants it was established the chemical composition of the meat (table 8).

Table 8

**The chemical composition of the Longissimus Dorsi muscle depending on the protein level of the ratio**

Nr.	Protein level	Chemical composition ( % )			
		SU	Protein	Fat	Ash
		1	2	3	4
		$\bar{X} \pm s_x$	$\bar{X} \pm s_x$	$\bar{X} \pm s_x$	$\bar{X} \pm s_x$
<b>Palas Merino</b>					
1.	High	27,88±1,9100	7,21±1,1200	7,21±2,3000	1,06±0,0320
2.	Low	28,77±1,4500	19,90±0,5800	7,91±1,9500	0,97±0,0200
<b>Meat Line of Palas</b>					
1.	High	26,25±1,7800	19,42±0,3900	5,83±2,1900	1,00±0,0480
2.	Low	26,34±2,3400	19,19±0,5300	6,20±2,67	0,95±0,0500

**Note:** There were not emphasized statistically significant differences between the two levels of protein at each breed (Fisher Test  $p > 0,05$ ).

The obtained results show the fact that at both lambs of Palas Merino, and those of Meat Line of Palas the composition of meat had close values, not being significantly influenced by the protein level of the ratio. Thus, the content of meat in dry substance, protein and fats at Palas Merino was of 27,88-28,77%, respectively 19,62-19,90% and 7,21-7,91%.

At the lambs of the Meat Line of Palas the chemical composition of the meat was of 26,25-26,34% dry substance, 19,19-19,42% protein and 5,83-6,20% fat.

### 3. CONCLUSIONS

The results lead to the following conclusions:

- the intensive fattening of the lambs with fodder recipes that assure a protein level (PDI%) of 12% and respectively 14% of DS determines certain reasonable performances in the point of view of the weight increase and of the conversion of fodders into increasing rate;
- there were not emphasized significant differences between the growing performances and the quality of the carcasses between the two protein levels;
- the increase of the protein level of the ratios has influenced the rate of the adipose tissue in the carcass, this being significantly lower at the higher protein level, fact that suggests the necessity of increasing the protein level of the ratios of fattening over 14% (PDI), this influencing favorably the quality indicators of meat and the health of consumers.

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**THE BIO DIVERSITY OF THE INVERTEBRATE FAUNA FROM THE VITICULTURE ECOSYSTEM CRISTIAN “DEALUL BOILOR” (SIBIU COUNTY) AND ITS IMPORTANCE UPON ECOSANOGENESIS OF THE AGRARIAN ECOSYSTEM**

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**Key words:** soil, biodiversity, useful fauna, pest fauna

**SUMMARY**

The reduced number of the works of this kind in Romania as well as in the world made us to approach this theme. The data that were obtained through the report of the pests and the useful species allow us the evaluation of the future attacks against the vine. The study was done during 2009-2010 in the viticulture ecosystem in Cristian, Sibiu County. There were identified a number of 14 species of useful invertebrate and 12 species belonging to the pest fauna.

If for the biologists the biodiversity represents the diversity of the organisms and of species and their way of working, for the ecologists the biodiversity represents the diversity of the lasting interactions among the species. The biodiversity of the soil is a complex system made up of species or assembly of species among which there are established multiple relations, which offer to the integrating system functions and services in order to assure its stability. The biodiversity of the soil through the services it can offer can be considered a key component in the system soil-plant-man, having a determining influence in its working. Monitoring the biodiversity offers us data about the quality of live and its durability. In order to emphasize the way of live and the ecologic functions of the trophic chains done by every species within the researched agrarian ecosystem, these are going to fall into two groups: pest species and useful species; the obtained report will indicate the state of equilibrium or unbalanced, imposing to take the adequate measures. The performance of the soil sustains the agriculture production and contributes to the recover of the environment (Berca, 2006), being an element of food security and economic durability.

The ecologic researches regarding the report between the useful and pest fauna were less approached in our country concerning the viticulture system, so it determined us to write about this theme. The data were obtained by comparing the percentage of the main pests as well as of the useful species that allowed us to evaluate as close to reality as possible the situation of the future dangerous attacks against the vine.

The researched biotope in the viticulture ecosystem in Cristian-Sibiu belongs to the brown-reddish soils area of forest that is favorable to the culture of fruit trees, and especially to the vine.

The climate in this area is temperate continental, having an annual average of the temperature of 8.9° C. The months with the highest temperatures are July and August with 18.7° C, and the lowest temperatures were registered in January: -3.4° C.

### 1. MATERIAL AND METHOD

In order to collect the samples of invertebrates there were used the following methods:

1. The testing method. The samples had the following sizes: 25/25/30cm. At every testing was taken by direct gathering the invertebrate fauna.
2. The traps with litter 50/50/10cm, installed on 20<sup>th</sup> November 2009 were raised on 8<sup>th</sup> April 2010. The collected material fixed in spirits 70% was brought into the lab and determined with the help of the binocular magnifying glass S. M. XX – the family, the gender and species. Totally there were 217 samples.

### 2. RESULTS AND DISCUSSIONS

From the analyzed material there were determined the groups of useful and pest fauna, as it follows in the table 1:

Table 1

**The useful and pest fauna from the viticulture ecosystem, locality Cristian – Sibiu County (20<sup>th</sup> .11. 2009 – 8<sup>th</sup> .04.2010)**

Nr.	Gender and species	Sample 1	Sample 2	Sample 3	Sample 4	Numerical abundance	Relative abundance
Useful fauna							
1	<i>Scutigera immaculata</i> L. – Symphyta, Miriapoda	2	1	-	-	3	2,09
2	<i>Lithobius formicatus</i> L. – Miriapoda	-	1	1	1	3	2,09
3	<i>Allolobophora caliginosa</i> L. Lumbricidae, Anelidae	3	-	-	-	3	2,09
4	<i>Fridericia bulbosa</i> Ross. - Enchytreidae, Anelidae	3	8	11	3	25	17,49
5	Araneae – Lycosidae, Salticidae	2	9	10	14	3,5	24,49
6	<i>Eremocoris abietis</i> L. – Heteroptera, Lygaeidae	-	4	4	2	10	6,99
7	<i>Nabis ferus</i> L. – Heteroptera	1	2	2	1	6	4,20
8	Formicidae – Hymenoptera	3	4	1	3	11	7,71

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9	<i>Coccinella 7 pct</i> L. – <i>Coccinellidae</i> , <i>Coleoptera</i>	-	3	-	2	5	3,49
10	<i>Cantharis Fusca</i> L. – <i>Cantharidae</i> , <i>Coleoptera</i>	1	1	2	1	5	3,49
11	<i>Aphodius Luridus</i> F. - <i>Scarabaeidae</i> , <i>Coleoptera</i>	1	-	3	-	4	2,79
12	<i>Staphylinidae</i> – <i>Coleoptera</i>	5	6	8	6	25	17,49
13	<i>Idiochroma dorsalis</i> L. – <i>Coleoptera</i>	-	2	2	2	6	4,20
14	<i>Brachynus psophie</i> L. – <i>Coleoptera</i>	-	-	1	1	2	1,39
	Total useful fauna	21	41	45	36	143	100 %
Pest fauna							
1	<i>Porcellio scaber</i> L. – <i>Isopoda</i> , <i>Crustacea</i>	9	3	3	4	19	25,69
2	<i>Blaniulus guttulatus</i> Bosc. – <i>Iulidae</i>	-	2	2	-	4	5,40
3	<i>Tomoceras longicornis</i> Lubb. – <i>Collembola</i>	1	2	1	3	7	9,45
4	<i>Bembidion properans</i> L. – <i>Carabidae</i> , <i>Coleoptera</i>	-	2	3	4	9	12,17
5	<i>Amara aeneae</i> Dejean – <i>Carabidae</i> , <i>Coleoptera</i>	5	3	6	2	16	21,64
6	<i>Blitophaga (Aclypea)</i> <i>undata</i> Müll. - <i>Silphidae</i> , <i>Coleoptera</i>	-	-	1	-	1	1,35
7	<i>Dermestes frischii</i> Kuhl. – <i>Dermestidae</i> , <i>Coleoptera</i>	1	-	1	-	2	2,70
8	<i>Harpalus pubescens</i> L. – <i>Carabidae</i> , <i>Coleoptera</i>	1	-	1	-	2	2,70
9	<i>Harpalus puncticollis</i> Payk. – <i>Carabidae</i> , <i>Coleoptera</i>	-	-	4	1	5	6,75
10	<i>Harpalus seripes</i> Quer – <i>Carabidae</i> , <i>Coleoptera</i>	-	4	2	1	7	9,45
11	<i>Stratiomyidae</i> – <i>Diptera</i> (larvā)	1	-	1	-	2	2,70
	Total pest fauna	18	16	25	15	74	100%

As it results from the table 1 there were met 11 species of pest fauna and 14 species of useful fauna.

From the former category we want to emphasize the abundance both numerical and relative one of the following species *Porcellio scaber* L., *Amara aeneae* Dejean, *Bembidion properans* L, *Tomoceras longicornis* Lubb., *Harpalus seripes* Quer., because they exceeded the economic limit of harmfulness.

From the category of useful species we want to underline the high abundances of the following groups and species *Araneae*, *Fridericia bulbosa* Ross., *Staphylinidae*, *Formicidae*, *Eremocoris abietis* L. (*Heteroptera*).

The report of the samples from each category as well as the number of species establishes a situation categorically in favor of the useful fauna.

The total report of Useful fauna / Pest fauna is 65.8% / 34.11%.

### 3. CONCLUSIONS

1. The researches were done in Cristian area (Sibiu County) during 20<sup>th</sup> November 2009 – 8<sup>th</sup> April 2010, obtaining data about useful fauna and pest fauna.

2. The fact that the useful fauna exceeded twice the pest fauna in the vine ecosystem in Cristian determined us to establish that for a period of 2 years, 2011 – 2012 there are not going to be major attacks of the main pests of the vine.

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**NUTRITIVE VALUE SOME OF RANGE SPECIES CONSUMED BY SHEEP AND GOATS IN CHAHARMAHAL & BAKHTIARI PROVINCE, WEST OF IRAN. 1. CHEMICAL COMPOSITION**

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**Key words:** Range species, chemical composition, sheep, Iran.

**SUMMARY**

Native range species from western part of Iran, Such as *Agropyron intermedium*, *Bromus tomentellus*, *Hordeum bulbosum*, *Cosinia bakhtiarica* and *Scariolla orientalis*, an introduced species, which are consumed by rang sheep and goat were evaluated to in semi- arid condition. Chemical composition of CP, EE, CF, for these species were assessed at 3 stage of growth between in four years using standard technique. The CP content in all species was significantly different between phenological stages. Maximum CP was found in growing stage of *Hordeum bulbosum* and the minimum was in seedling stage. The CF content in most of species was significantly different between phenological stages too. The minimum CF was found in *Agropyron intermedium* and the maximum was found in *Cosinia bakhtiarica*. The results showed which phenological stage of growth had significant influences on forage quality, with increased Iranian range plant development, CP was decreased rapidly and crud fiber increase. In the early stage of growth, the quality of Semi- arid area range species is adequate for livestock production but during that stage, the greatest problem is quantity and availability.

For the purpose of maintaining sufficient growth and reproductive performance, animal producers need to comprehend the nutritional changes of range forage (Ramirez et al., 2004). The most principal factors limiting the performance of grazing animals are low protein content of grasses, low energy intake due to high fiber content. In Chaharmahal Bakhtiari province, which is located in the western part of Iran, there has been a long history of livestock grazing and nomadic. A high majority of the sheep and goats population is managed under a migratory system, utilizing the ranges as the major source of feed. Furthermore, the feeds available from natural grazing are limited and of low quality, and periodic drought is also a constraint (Farid et al., 1977; Shadnoush et al., 2004).

The climate in these regions is semi- arid with precipitations during autumn, winter and a lot of in early spring only. The nutritive value of herbage depends not only on the growth or maturity of the plants, but also on the seasonal variation and climatic conditions. Additionally, the variation among the species of one family for nutrient content may be important. (Shakerian et al., 2004; Shadnoush et al., 2004). It has also been observed that CP and CF in range plants follow the same pattern (Ramirez, 1999). The nutritive value of forages as well as herbage can be determined by their chemical composition (Shakerian et al., 2004; Ghoorchi, 1995). The aim of this study was to assess the nutritive value potential and seasonally the nutritional dynamics of five native dominant range plant species in semi- arid rangeland of Chaharmahal- Bakhtiari province

which is located in the western part of Iran, which are consumed principally by range goats and sheep and there is little information about them.

### 1. MATERIAL AND METHOD

The study was carried out on five different controlled stations of Shahrekord, Broujen, Farsan, Lordegan and Ardal (Table 1.). The average elevation of area is 2000m. The climate of this region is considered semi- arid with annual mean temperature of 11.2 o<sup>c</sup> and about 700 mm precipitation which is also very erratic and the variant is 30, 52 and 18 percent in fall, winter and spring respectively, but 4-5 months of the year is dry (Reisian, 1998). During the study period the average precipitations was 500 mm.

The grasses *Agropyron intermedium*, *Bromus tomentellus*, *Hordeum bulbosum*, *Cosinia bakhtiarica* and *Scariolla orientalis* were collected from ungrazed area for nutritional studies, during growing, blooming and seedling stages (May- Sep). As encountered on the range, grasses were hand harvested at 2 cm above ground level, composite by species in each of three-growth stage and area in four years. Samples were stored in a paper bags in the field and transported to the laboratory. The unwashed samples were air- dried, and then ground in a mill (1 mm) and stored in plastic containers for further analysis. Samples were analyzed for DM, CP, EE, CF and ash (AOAC, 1990).

Data were statistically analyzed using a complete randomized block design with four replications and two factors: grasses (5) and phenology stage (3), by GLM of SAS (2001) and statistical indices such as means and standard error, were obtained.

### 2. RESULTS AND DISCUSSIONS

Means of chemical composition and overall means of sample is shown in Table 1. Mean nutrient contents of species were 8 percent<sup>-1</sup> DM CP (rang 6.7-8.8), 3.1 percent<sup>-1</sup> DM EE (rang 2.2- 4.1), 37.2 percent<sup>-1</sup> DM CF (range 31.5- 42), 7.5 percent<sup>-1</sup> DM Ash (rang 6.7- 8.5) and 4.2 Mcal kg<sup>-1</sup> DM GE (rang 4.1- 4.3) with significant differences between almost of species. Chemical analysis of samples shows that some nutrients between families within and among species were significant differences (P<0.05). Also the forage is rich in protein with relatively low fiber content. Results of other research agreed with these finding (Arzani et al., 2004; Ramirez et al., 2004).

Table 1

Means and standard error for chemical composition of rang species sample

Species	No	Percent <sup>-1</sup> DM				Mcal kg <sup>-1</sup> DM GE
		CP	EE	CF	Ash	
<i>Agropyron intermedium</i>	56	8.6±0.39 <sup>b</sup>	3.1±0.18 <sup>b</sup>	31.5±0.73 <sup>a</sup>	8.5±0.2 <sup>c</sup>	4.3±0.06 <sup>a</sup>
<i>Bromus tomentellus</i>	55	7.9±0.4 <sup>b</sup>	2.2±0.2 <sup>a</sup>	35.2±0.8 <sup>b</sup>	7.5±0.2 <sup>b</sup>	4.2±0.06 <sup>a</sup>
<i>Hordeum bulbosum</i>	44	8.8±0.5 <sup>c</sup>	2.3±0.2 <sup>a</sup>	34.8±0.9 <sup>b</sup>	8.2±0.3 <sup>c</sup>	4.2±0.67 <sup>a</sup>
<i>Cosinia bakhtiarica</i>	60	8±0.4 <sup>b</sup>	3.8±0.2 <sup>c</sup>	42±0.7 <sup>c</sup>	6.8±0.2 <sup>a</sup>	4.3±0.06 <sup>a</sup>
<i>Scariolla orientalis</i>	58	6.7±0.4 <sup>a</sup>	4.1±0.2 <sup>c</sup>	40.2±0.7 <sup>d</sup>	6.7±0.2 <sup>a</sup>	4.1±0.06 <sup>a</sup>
Overall mean	-	8±0.4	3.1±0.2	37.2±0.75	7.5±0.2	4.2±0.06

Means with different letters (a, b, c and d) in the same column of each species differ significantly (P<0.05).

### 2.1. CRUD PROTEIN

Overall mean of CP content is shown in Tabl 1. Mean CP content of forages were 8% (range 6.7-8.8%), which the minimum was found in *Scariolla orientalis* 6.7% and the maximum CP was found in *Hordeum bulbosum* 8.8%, the differences between minimum and maximum were significant ( $P<0.05$ ). The CP content in all species was significantly different between phenological stages. Maximum CP was found in growth stage and the minimum in seedling stage ( $P<0.05$ ). Growth stage had high and seedling low content of CP in all species. Maximum CP was found in growing stage of *Hordeum bulbosum* (15.2%) and the minimum was in seedling of *Hordeum bulbosum* (2.9%) between all of species.

All forage exhibited their most rapid increase in CP concentration in growth stage, and then slowly decrease in Blooming stage and in Seedling stage exhibited lowest content of CP in phenological stages. These phenological fluctuations in CP content may have been induced by the high spring and less autumn precipitations in native range forages, the ratio of leaves to stem is an important factor, which affected CP content in phenological stages and between species. Seasonal changes of CP during different phenological stages were reported by Arzani et al (2004). They found that when plants became older, CP declined. In this study, forage CP of growing, blooming and Seedling stage was different ( $P<0.05$ ).

### 2.2. CRUD FIBER

Means of CF content for 5 native range species is shown in Table 1. Overall mean of crud fiber were 37.2% (range 31.5-42%), the minimum was found in *Agropyron intermedium* 31.5% and the maximum CF was found in *Cosinia bakhtiarica* 42%, which the differences between them were significant ( $P<0.05$ ). Also the table showed species belonged to a family might be differing for crud fiber significantly ( $P<0.05$ ). It Seems that Crud fiber contents in all species positively Correlated with CP content, this is agreed with finding of (Ramirez et al, 2004). The CF content in species was significantly different ( $P<0.05$ ) between phenological stages, except in blooming and Seedling of *Agropyron intermedium* and *Bromus tomentellus*, which was similar. *Scariolla orientalis* had the highest contents in seedling stag (45.6%) and *Agropyron intermedium* was mostly low in growing stage (28.5%), with significant differences ( $P<0.05$ ). It Seems that CF contents in native range species were influenced by climatic conditions, thus fiber and lignin in crease with maturity of plants, Because mature Stems contain more fibers compared with mature stems and leaves, which generally form from parenchyma tissues, Although in primary stage of penology like growing and flowering range species had a higher leaf- to- stem ratio would result reduction in CF content for this stage and increase in CF Seedling stage. Variety in CF during phenological stag, different species and between part of plant were reported by Ghoorchi, (1995); Arzani et al., (2004) and Ramirez et al., (2004). They concluded that with progress of plant growth and when plants became older, CF content increased in structural Carbohydrate, such as celluloses, hemi cellulose and lignin are increased. In this study CF of native rang plant was different ( $P<0.05$ ) mostly with progress of plant growth and between species.

### 3. CONCLUSIONS

Phenological stage of growth had a significant influence on forage quality. With in creased Iranian plants development, CP was decreased rapidly and the crude fiber increase. After plant maturity, even if the quantity is sufficient, because the quality is low, therefore it is not possible to meat even the maintenance requirement of the livestock. That is an important reason why animals lose weight on Iranian Summer and fall ranges. The range forage plant supply and its quality are adequate only for a limited time in the late spring and early summer each year.

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**NUTRITIVE VALUE SOME OF RANGE SPECIES CONSUMED BY SHEEP AND GOATS IN CHAHARMAHAL & BAKHTIARI PROVINCE, WEST OF IRAN. 2. CELL WALL CONTENTS AND *in vitro* DIGESTIBILITY**

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**Key words:** Range species, nutritive value, cell wall contents, *in vitro* digestibility, Iran

**SUMMARY**

Five common range forage species including *Agropyron intermedium*, *Bromus tomentellus*, *Hordeum bulbosum*, *Cosinia bakhtiarica* and *Scariolla orientalis*, were sampled in three years, during three phenology stages, from controlled rangeland stations located in Chaharmahal & Bakhtiari province, south west of Iran. Cell walls constituents of samples, neutral detergent fiber (NDF) and acid detergent fiber (ADF) determined by standard methods. The dry matter digestibility (DMD) and organic matter digestibility (OMD) were determined by using of *in vitro* two stages method. Results showed that NDF and ADF concentration were significantly ( $P < 0.05$ ) different between growing and blooming stages in most of the species. The minimum NDF and ADF were found in growth stage of *Scariolla orientalis* and *Agropyron intermedium* respectively, but the maximum were in seedling stage of *Hordeum bulbosum* and *Cosinia bakhtiarica*. The overall mean of *in vitro* dry matter digestibility (DMD) of range species was 48.4%. The dry matter digestibility (DMD) and organic matter digestibility (OMD) showed slightly reduction passing from growing to seedling stage in most of the species. Maximum DMD and OMD was found in growing stage of *Scariolla orientalis* and minimum was in seedling stage of *Bromus tomentellus*. Except for the species of *Cosinia bakhtiarica* and *Scariolla orientalis* there were no significant differences for DMD from growing to blooming and seedling stages. In general, OMD decreased from the growing to the blooming stages. It can be concluded that by progress of the growing stage toward the seedling stage, also the nutritive value of all species decreased because cell wall increased and *in vitro* digestibility decreased thus grazing animals oppose to nutrient deficiencies.

One of the most principal factors limiting the performance of grazing animals are low energy content of range species due to high fiber contents (MC Dowell, 1985). In Chaharmahal Bakhtiari province, there has been a long history of livestock grazing and nomadic (Shadnoush et al., 2004), utilizing the ranges as the major source of feed.

The climate in these regions is semi- arid with precipitations during autumn, winter and a lot of in early spring only. The nutritive value of herbage depends not only on the growth or maturity of the plants, but also on the seasonal variation and climatic conditions. The nutrient contents are much different between families. (Shakeri and Fazaeli, 2004; Shadnoush et al., 2004). The nutrient contents of range plant may be affected by the variation among the soils, rainfall, temperature and other ecological conditions. The nutritive value of forages as well as herbage can be determined by their cell wall contents and the digestibility (Shakeri and Fazaeli, 2004; Arzani et al., 2004). The aim of this study was to assess the nutritive value potential and seasonally the nutritional dynamics of five native dominant range plant species in semi- arid rangeland of Chaharmahal- Bakhtiari province which is located in the western part of Iran, which are consumed principally by range goats and sheep and there is little information about them.

## 1. MATERIAL AND METHOD

The study was carried out on five different controlled stations. The climate of this region is considered semi- arid with annual mean precipitation about 700 mm which is also very erratic and the variant is 30, 52 and 18 percent in fall, winter and spring respectively, but 4-5 months of the year is dry ( Reisian, 1998). During the study period the average precipitations was 500 mm. The grasses *Agropyron intermedium*, *Bromus tomentellus*, *Hordeum bulbosum*, *Cosinia bakhtiarica* and *Scariolla orientalis* were collected from ungrazed area during growing, blooming and seedling stages (May- Sep). As encountered on the range, grasses were hand harvested at 2 cm above ground level, composite by species in each of three-growth stage and area in four years. The unwashed samples were air- dried, ground in a mill (1 mm) and stored in plastic containers for further analysis. Samples were analyzed for cell walls constituents, NDF and ADF by the procedures of Van Soest et al. (1991). The DMD and DOMD were determined by using of *in vitro* two stages Tilly& Terry (1963) method. Data were statistically analyzed using a complete randomized block design with four replications and two factors: grasses (5) and phenology stage (3), by GLM of SAS (2001) and statistical indices such as means and standard error, were obtained.

## 2. RESULTS AND DISCUSSIONS

### 3.1. NEUTRAL DETERGENT FIBER AND ACID DETERGENT FIBER

NDF and ADF in all species mostly were significantly different between growing and blooming stages and for species were differ between species where belonged to one family (Table 1). *Bromus tomentellus* and *Cosinia bakhtiarica* had high annual means of NDF and ADF, however *Scariolla orientalis* and *Agropyron intermedium* were lowest. Minimum NDF and ADF were found in growth stage of *Scariolla orientalis* , *Agropyron intermedium* respectively, and the maximum were in seedling stage of *Hordeum bulbosum* and *Cosinia bakhtiarica* , which the differences between minimum and maximum of NDF and ADF were significant ( $P<0.05$ ). The high spring and less summer and autumn precipitation in native range plants may have induced these varieties. NDF and ADF in all species increased as plant growth progressed. Similar results were reported for NDF and ADF in range species by Arzani et al., 2004 and Shakeri and Fazaeli, 2004, they reported that with progress of plant growth, varieties in precipitation, ratio of protector and firmness tissues, which mostly consist of structural carbohydrates are increased.

### 3.2. DRY MATTER DIGESTIBILITY AND DRY ORGANIC MATTER DIGESTIBILITY

Overall mean *in vitro* dry matter digestibility (DMD) of range species was 48.4% (Table 2). The content of DMD in most of species nearly showed slight reduction passing from growing stage in spring to Seedling stage in summer and autumn. The highest DMD had observed in growing stage of *Scariolla orientalis* and the lowest was in *Bromus tomentellus* the low DMD observed in blooming and seedling stage may be due to higher NDF contents in the matures samples. This agreed with results obtained by Arzani et al., (2004), which reported dry matter digestibility of plant parts mainly decreased with

growth progress. Also overall mean of *in vitro* dry organic matter digestibility (DOMD) of 5 range species was 58.4% (Table 2). Like DMD content in most of range plant DOMD concentration showed slight decrease with progress of plant growth, specially passing blooming to seedling phenological stage. Maximum DOMD in growth stages was found in growing stage of *Scariolla orientalis* and minimum was in seedling stage of *Bromus tomentellus*. It may be because of higher DOMD of *Scariolla orientalis* in growing stage, usually had been good grazing by sheep and goats in this stage but ungrazed in other stages. In general DOMD decreased between the growing and blooming stages as a considerable, than decreased slightly. This agreed with reports Ghadaki et al., (1974) they has shown that the differences in digestibility between grasses in arid- zone and temperate- zone could be explained by the differences in the amounts of precipitation in this area.

### 3. CONCLUSIONS

Phenological stage of growth had a significant influence on forage quality. With increased Iranian plants development, DMD and DOMD were decreased rapidly and the ADF and crude fiber increase. In the growing stage of growth, the DOMD of grass species high, and the quality of this is adequate for livestock production. But the greatest problem is the quantity and availability of the forage, which in most cases is not sufficient. After plant maturity, even if the quantity is sufficient, because the quality is low, therefore it is not possible to meat even the maintenance requirement of the livestock. The range forage plant supply and its quality are adequate only for a limited time in the late spring and early summer each year.

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Table 1.

**Variation in NDF (percent<sup>-1</sup> DM) and ADF between five range species and among phenological stages**

Species	Sampling No			NDF			Mean	SE	ADF			Mean	SE
				Phenological Stages					Phenological Stage				
	G	B	S	G	B	S	G	B	S				
<i>Agropyron intermedium</i>	18	19	21	62.8 <sup>ab</sup>	68.1 <sup>bb</sup>	74.5 <sup>cb</sup>	68.4 <sup>B</sup>	±1.9	35.3 <sup>aA</sup>	40.5 <sup>bA</sup>	46.1 <sup>cA</sup>	40.6 <sup>A</sup>	±1.2
<i>Bromus tomentellus</i>	15	19	20	65.5 <sup>ab</sup>	74.2 <sup>bc</sup>	78 <sup>bb</sup>	72.5 <sup>B</sup>	±2	38.1 <sup>aA</sup>	41.2 <sup>bA</sup>	47.7 <sup>cA</sup>	42.3 <sup>A</sup>	±1.4
<i>Hordeum bulbosum</i>	13	15	14	63.6 <sup>ab</sup>	74.5 <sup>bc</sup>	78.3 <sup>bb</sup>	72.1 <sup>B</sup>	±2.2	35.7 <sup>aA</sup>	43.2 <sup>bA</sup>	50.7 <sup>cb</sup>	43.2 <sup>A</sup>	±1.5
<i>Cosinia bakhtiarica</i>	20	21	20	58.5 <sup>aA</sup>	66.4 <sup>bb</sup>	65.6 <sup>bA</sup>	63.5 <sup>A</sup>	±1.8	44.8 <sup>aC</sup>	51.3 <sup>bb</sup>	53.7 <sup>bc</sup>	49.9 <sup>B</sup>	±1.2
<i>Scariolla orientalis</i>	20	19	19	54.9 <sup>aA</sup>	61.1 <sup>bA</sup>	66.3 <sup>cA</sup>	60.7 <sup>A</sup>	±1.9	41.5 <sup>ab</sup>	49.9 <sup>bb</sup>	54.6 <sup>cc</sup>	48.6 <sup>B</sup>	±1.3

G: growth stage; B: blooming stage; S: seedling stage; SE: standard error of mean

Means within species and a phenological stage in a row followed by different lowercase letter (a, b, c) are significantly different (P<0.05).

Means of phenological stage between species in a column followed by different uppercase letter (A, B, C, D, E) are significantly different (P<0.05).

Table 2.

**Variation in DMD% and DOMD between five range species and among phenological stages**

Species	Sampling No			DMD			Mean	SE	DOMD			Mean	SE
				Phenological Stages					Phenological Stage				
	G	B	S	G	B	S	G	B	S				
<i>Agropyron intermedium</i>	18	19	21	50.6 <sup>aA</sup>	50.2 <sup>aA</sup>	46.4 <sup>aA</sup>	49 <sup>A</sup>	±2.7	59.9 <sup>aA</sup>	59.3 <sup>bbB</sup>	56.2 <sup>bb</sup>	58.6 <sup>BC</sup>	±2.9
<i>Bromus tomentellus</i>	15	19	20	49.1 <sup>aA</sup>	45.3 <sup>aA</sup>	41.7 <sup>aA</sup>	45.3 <sup>A</sup>	±2.8	56.9 <sup>aA</sup>	51.9 <sup>bA</sup>	47.6 <sup>cA</sup>	52 <sup>A</sup>	±3
<i>Hordeum bulbosum</i>	13	15	14	54.6 <sup>aA</sup>	49.9 <sup>aA</sup>	45.6 <sup>aA</sup>	50 <sup>A</sup>	±3.2	63.7 <sup>aA</sup>	56.5 <sup>aAB</sup>	52.2 <sup>bAB</sup>	57.5 <sup>AC</sup>	±3.4
<i>Cosinia bakhtiarica</i>	20	21	20	53.2 <sup>aA</sup>	45.4 <sup>bA</sup>	42.8 <sup>ba</sup>	47.1 <sup>A</sup>	±2.6	62.2 <sup>aA</sup>	50.3 <sup>bA</sup>	50.9 <sup>baB</sup>	54.5 <sup>AB</sup>	±2.9
<i>Scariolla orientalis</i>	20	19	19	58.6 <sup>ab</sup>	48.3 <sup>bA</sup>	45.3 <sup>ba</sup>	50.7 <sup>A</sup>	±2.7	71.7 <sup>ab</sup>	58.1 <sup>bb</sup>	55.3 <sup>bb</sup>	61.7 <sup>C</sup>	±2.8
							48.4	±2.8				58.8	±3

G: growth stage; B: blooming stage; S: seedling stage; SE: standard error of mean. Means within species and a phenological stage in a row followed by different lowercase letter (a, b, c) are significantly different (P<0.05). Means of phenological stage between species in a column followed by different uppercase letter (A, B, C, D, E) are significantly different (P<0.05).



## **CHALLENGES FACED BY BULGARIAN AGRICULTURE IN THE CONTEXT OF THE EU'S COMMON AGRICULTURAL POLICY AND THE EUROPE 2020 STRATEGY**

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**Key words:** agriculture, strategy, Bulgaria

### **SUMMARY**

Bulgarian livestock husbandry continues to play an important role for procurement of population with foodstuffs, for food security and is a main source of income for people, particularly in rural regions which are essential in the economic crisis environment.

The common Agricultural Policy (CAP) is now facing numerous challenges that require purposeful action from the EU for the future long-term development of agriculture and rural regions. The CAP would effectively respond to the challenges if sound economic policies and sustainable public finances contributing to achieving the aims of the EU are available (European Commission 2010), namely:

- Long-term preservation of the potential for production of foods in EC countries. This would assure the food security of E citizens and would meet the increasing needs for foods on a global scale as well as would contribute to overcome the frequent market instability due to climatic changes.
- Support of agricultural communities which provide European citizens with high-quality, valuable and diverse food produced in compliance with the requirements for sustainable development.
- The active management of natural resource through agriculture is a main tool for protection of the rural environment and biodiversity in order to reduce the consequences of climatic changes, which could guarantee the dynamic development of these territories and the long-term economic viability.
- Maintenance of viable agricultural communities where agriculture is an important economic activity creating employment at a local level. The CAP reform should be aimed at enhancing the competitiveness, at the more efficient use of financial resources, the food security, the environment, at establishment of more sustainable, more intelligent and stronger growth of European rural regions.

The first pillar of the future CAP would be in harmony with the environment while the second would be focused on the competitiveness and innovations that would release the hidden production potential. The efficacy of financial support would increase through

exclusive directing of subsidies towards active agricultural producers and remuneration of collective services. This would give a better legitimacy of the CAP. The control and the continuous work on simplification of procedures would be realized in conditions of limited financial funds and the negative impact of the economic crisis on agriculture.

Agricultural production is a main branch of the Bulgarian economy with exceptional role with regard to food security and maintenance of the life standard of the population. Agriculture has been and will always be very important for the procurement of the people with animal foodstuffs. It is a reliable source ensuring the employment and the income of a major part of Bulgarian citizens. It is related to utilization of natural resources, maintenance of ecological balance, and provision of raw sources for the manufacturing industry and to a considerable income for the national economy.

The global economic crisis has led to a number of obstacles to Bulgarian livestock husbandry and to a considerable drop in its development rate.

#### **STATE OF LIVESTOCK HUSBANDRY AND TRENDS IN ITS DEVELOPMENT**

The development of Bulgarian livestock industry during the last few years, the changes in the number of farms (Stankov, I. et al. 2005), the number of livestock are directly related to the organizational, structural and normative changes issuing from the membership in the EU and the national economic environment .

What happened during the past several years?

➤ The request of Bulgaria for extending the grace period – until the end of 2011 with regard to the processing of milk that does not meet the requirements. As a result, the update, equipment, and modernization of the material base in compliance with the requirements of the application of CAP are continuing.

➤ The application of the (S) EUROP qualification of carcasses would improve the market presence inside and outside the EC. In order to stimulate the producers in 2009 the Ministry of Agriculture and Food and the Management Board of the State Fund Agriculture have granted a targeted subsidy for qualification of carcasses from cattle, pigs and sheep.

➤ The implementation of the National Apiculture Programme (for 2008-2010) has improved the general environment for production and trade with bee honey and bee products (Nenchev, P., et al. 2008). The next programme period is from 2011 to 2013.

➤ A system for support of livestock husbandry by state subsidies, national payments and credit lines is developed.

➤ The Programme for Rural Development has started.

➤ In 2010, the number of livestock farms continued to decrease. The reduction affected mainly farms rearing from 1 to 9 female breeding animals.

➤ Consolidation and concentration of livestock production has begun:

- 62% of dairy cows are reared in farms with more than 10 cows;

- 58% of buffaloes are reared in farms with more than 20 animals

- Farms with more than 100 inseminated sheep increased by 16.8%;

- Farms with 50 and more goat does increased by 15.2%;
  - 77.1% of breeding sows are reared in farms with more than 50 sows;
  - More than 52% (182 thousand) finisher pigs are reared in 39 farms;
  - Farms rearing more than 100 000 hens and pullets increased by 13.6%;
  - Farms rearing from 10 000 to 100 000 broiler chickens increased by 31%.
- A reduction of the drop and a slight increase in cattle population – by 0.9% (by 4.51% for dairy cows), buffaloes – by 10.84% (by 8.0% in buffalo cows), of bee families – by 0.82% and of rabbits – by 4.32% have occurred. The number of the other animals and birds has decreased – by 2.29% in sheep (by 3.75% in ewes), by 1.25% in goats (by 8.30% for goat does), by 9.02% in pigs (by 24.09% in sows), by 8.4% in poultry (by 11.1% in layer hens) and by 0.31% in equids (Table 1).
- In 2010, a total of 1 277 704 t milk (including 1 124 360 t cow milk, 85 001 t sheep and 60 410 t goat milk) was produced in Bulgaria that is by 45 944 t (3.73%) more as compared to 2009. The change for cow and buffalo milk is by +4.75% and +12.97%, respectively, whereas for sheep and goat milk there is a reduction by 2.57% and 5.75% respectively (Table 2).
- The average milk production of cows in 2010 was 3 542.3 L, of buffalo cows – 1 412.2 L, of ewes – 81.2 L and of goat does – 211.2 L.
- In 2009, the produced meat (as total slaughter weight) was 242 624 t i.e. by 9.1% more than 2008. A reduction of produced red meat by 1.1% is observed together with increase in white meat by 19.9%. Egg production was slightly increased – by 0.6%. A considerable drop in bee honey production occurred in 2009 that was by 16.2% less than 2008.

Table 1

**Number of animals in Bulgaria (in thousands) (2001-2010)**

Animal species	2001	2003	2008 by 01.11	2009 by 01.11	2010 by 01.11	Change 2010/2009, %
Cattle	634	668	564.9	539.6	544.5	+ 0.90
Cows	419	356	330.4	312.7	326.8	+ 4.51
Buffaloes	8	9.6	9.2	8.3	9.2	+10.84
Buffalo cows	5	4.4	5.3	5.0	5.4	+ 8.00
Sheep	2 286	2 075	1 474.8	1 400.3	1 368.0	- 2.29
Ewes	1 758	1 370	1 198.1	1 135.5	1 093	- 3.75
Goats	970	1 060	429.8	360.8	356.3	- 1.25
Does	790	616	355.2	303.1	278.0	- 8.30
Pigs	1 144	1 117	783.6	729.8	664.0	- 9.02
Sows	137	77	76.8	71.4	54.2	-24.09
Poultry – total	14 991	18 138	17 549	17 400	15 934	- 8.4
Layer hens	7 883	8 162	8 798	8 778	7 800	-11.1
Bee families	349	311	652.6	624.9	630.0	+ 0.82
Equids			175.1	170.5	170.0	- 0.31
Rabbits			303.2	118.0	123.1	+ 4.32

Table 2

**Animal production (2008-2010)**

<b>Production of:</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>Change 2010/2009 %</b>
<b>1. Milk, total, tonnes</b>	<b>1 316 071</b>	<b>1 231 760</b>	<b>1 277 704</b>	<b>+ 3,73</b>
Cow milk	1 143 190	1 073 401	1 124 360	+ 4,75
Buffalo milk	7 173	7 022	7 933	+12,97
Sheep milk	88 243	87 247	85 001	- 2,57
Goat milk	77 465	64 090	60 410	- 5,75
<b>2. Meat, total slaughter weight, tonnes</b>	<b>232 280</b>	<b>243 624</b>	-	-
Red meats	114 718	113 461	-	-
White meat	108 562	130 163	-	-
<b>3. Eggs, thousands</b>	<b>1 507 909</b>	<b>1 429 221</b>	<b>1 430 951</b>	<b>+ 0,6</b>
<b>4. Bee honey, tonnes</b>	<b>11 377</b>	<b>9 529</b>	-	-

Source: Ministry of Agriculture and Foods, Agrostatistics

For the period from 01.11. 2009 to 01.11. 2010, a total of 2606 thousand of animals were sold by farms, that makes by 4.2% less than the preceding period. The pigs sold for meat production are by 6.9% less and large ruminants – by 7.1% less.

In 2010, the total number of live animals exported from Bulgaria was about 210 thousand, including 41 thousand cattle and about 164.4 thousand sheep. For the same period, more than 289 thousand of animals were imported, out of which 258 thousand sheep, 17.2 thousand pigs and 3.1 thousand cattle.

Fishery and aquaculture occupy an important place in the EC economic policy. Being an independent branch, a Common Fisheries Policy (CFP) has been developed. With the EU membership of Bulgaria and the improved life standard and purchasing power of the population, an intensification of the branch is anticipated.

With its 70 thousand hectares cadastral water area, Bulgaria has resources that could be used for aquaculture purposes - – 30 000 hectares dams, 3 700 hectares warm water and 40 hectares cold water pools. Sea and fresh water aquaculture dispose with an adequate base for development. There is an interest for the cultivation of different hydrobiont species in recirculation systems (Staykov, J. et al. 2004).

At present, the total annual production of hydrobionts in Bulgaria is about 8 000 tonnes (Table 3).

The fish draught in Bulgaria tends to increase continuously. For the past year only, the total increase is by 97.65%, with highest increased (more than twofold) of cyprinids that are most popular for consumption. The production of mussels and other aquaculture species is also increased, thus providing a various assortment of products on the market. This is in

compliance with the EU strategy for improvement and diversity of foods and for complete meeting of consumers' needs for healthy food.

Table 3

**Aquaculture production in Bulgaria (tonnes)**

<b>Aquaculture production</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2010</b>	<b>Change 2010/2005, %</b>
<b>Total, including.</b>	<b>2 898</b>	<b>3 311</b>	<b>4 035</b>	<b>7 975</b>	<b>+97.65</b>
Carp	1 091	924	1 313	4 000	+204.65
Other cyprinids	420.6	644.4	556.7	1 500	+169.44
Salmonids	1 028.6	1 578.6	1 562.2	2 000	+28.02
Acipenserids	155.0	18.5	310.0	220	-29.04
Silurids	179.9	17.8	211.7	150	-29.15
Black sea mussels	15.0	117.7	70.7	90	+27.29
Other species	7.8	9.4	10.3	15	+45.63

### **CHALLENGES FACED BY BULGARIAN AGRICULTURE**

One of the great challenges to livestock husbandry emerging after the privatization in Bulgaria is the choice between many farms with few animals or few farms with lot of animals.

In 2010, 93 700 dairy cows (30.4% of all dairy cattle) are reared in farms with 1 to 4 animals. The number of farms housing 20 and more cows has increased by 48.9%, as did the number of reared animals – by 39.2%. Farms rearing beef cattle increase by 20%, and cows – by 17.0% – with 18 643. Farms with 1-2 beef cows decreased by 21.9%. The number of farms with 3 to 9 beef cows increased almost twice, as the animals kept in them. The tendency towards consolidation in cattle breeding is continuing and by now, modernly equipped farms for 500, 1 000 and even 2 000 cows are built. One of advantages of large farms is that their owners usually dispose of significant financial resource allowing modernization, introduction of modern production systems, including robotization of milking. This trend is in concordance with the global trend for reduction of farms number and increase in their capacity and with the continuously increasing demands for a high-quality production resulting from increasing competitiveness and higher quality standards and from the decrease of people employed in this sector.

➤ With respect to the implementation of the Strategy for dairy cattle husbandry development, the categorization and recategorization of cattle farms in 3 categories will go on for fulfillment of veterinary sanitary and animal hygiene requirements to animal breeding facilities and the quality of produced milk. Until the end of 2011, farms that are not compliant with I category requirements, should do the necessary to meet the standards.

➤ One of the great challenges to dairy husbandry with a significant impact on the sector, is the ratio between fodder costs and the purchase price of milk. The generally

accepted efficiency coefficient in cow milk production – i.e. the ratio between the purchase price of cow milk and the price of concentrate feed, should not be lower than 1:2.5 for compound feed and 1:3 for fodder wheat. In Bulgaria, these ratios are rather low, far from what is desired and rarely exceed 1:1.5. The maintenance of low ratio in the dairy sector does not result in profitability.

➤ There is a need for foundation of intervention agency that should maintain over the entire year almost constant prices of milk during the different seasons and different regions in the country. The existing seasonal pattern in produced milk and with regard to its price is a negative trait of the national milk production.

➤ A challenge for livestock producers is the introduction of protection (threshold) prices. This would avoid the monopolistic behaviour of firms dealing with purchase and processing of milk that make great profit on the detriment of producers. This would allow the normal profit in an animal farm and real preconditions for investment in better nutrition, modernization, improved rearing conditions and extensive reproduction. The low revenue and profitability do not allow a more extensive reproduction and that is why producers are forced to practice non balanced or deficient feeding that then reflects in low production rates.

➤ The timely provision of subsidies is a challenge related to the specifics of livestock production, which requires a rhythmic supply with feeds to maintain the normal production rate. The funding provision in critical moments for support of production or purchase of feed is extremely important. The irregular payments hold back the livestock production instead of stimulating it.

➤ The cooperation (forming of groups of producers) and creation of powerful associations is a serious challenge to producers as an option for group defense of their common interests. Having in mind the fairly low aspirations of farmers for efficient cooperation, this process needs to continue. The efficacy of cooperation would be higher if producers, processing enterprise owners, traders and consumers are associated. Cooperations of such a type permit a sure and fair distribution of the profit between all stakeholders, use of research achievements and improvement of technologies at all levels as per demands of consumers (Atanassova, T. 2003).

➤ A very important challenge to Bulgarian agricultural producers is the increasing demand of consumers for a high-quality production and its impact on human health. The pressure and demand for more correct information about consumed animal foodstuffs are also higher. The implementation of Commission Regulation 178/2002 laid down the procedures in matters of food safety. HACCP system and the EU implemented Commission Regulations № 852, 853 and 854 of 2004 that imposed a strict control on animal foodstuffs production. The food quality is certified according to the HACCP system and ISO 22000. A special attention is paid on Commission Regulation 1254, setting rules for the trade with live animals, beef meat and beef products. A new standard Stara Planina was introduced for some animal foods. The demands of consumers to the dairy industry are aimed to a normal maturity of brine cheese and yellow cheese, information about the real content of the product and guarantee of

its quality. One of challenges in this field is the choice between production and consumption of dairy products with plants fat or more expensive but natural dairy products. The control on the implementation of regulations set with regard to compliance with animal hygiene, animal welfare, identification and the movements, regular record keeping, prevention and treatment of animals, and production and realization of animal foodstuffs is delegated to the newly created National Food Safety Agency in 2010.

➤ The increased interest to safe and healthy foods originating from organic farms is another challenge to Bulgarian livestock husbandry. There is a need for selection of suitable species and types of crops, well-adapted to different ecological conditions and to adjust technologies to organic animal rearing.

➤ Another challenge faced by animal producers, especially in semi-mountainous and mountainous areas, is the development of regional, boutique brands with specific features. The standardization of these products and their geographic determination would allow an expansion of market niches, diversity of products and better options for preserving and sustainable development of livestock breeding with a special emphasis on regions with adverse climate, relief and crop resources.

➤ The rational use of natural pasture swards is a resource for the better development of livestock husbandry. In Bulgaria, they amount to 1.9 billion hectares, i.e. one-third of cultivable land (D Pavlov, 2007). This is an essential resource for livestock breeding in premountainous and mountainous regions and a good source of not expensive biomass with a good nutritive value for breeding of ruminants (D. Pavlov, et al 2007).

➤ An important challenge to animal husbandry is the condition of incessantly increasing price of fuels. This implies to seek new alternative solutions for reduction of the energy dependence of animal farms. Having in mind the restricted energy resources of the country, a possible and appropriate trend is the development and utilization of renewable energy sources. In animal breeding, one alternative of traditional energy sources is the production of biogas from manure that could meet the needs or part of the needs of farms (Dinev, D. 2006). The high cost of equipment of biogas production and the needed investments are however obstacles impeding the benefit from this option.

➤ Biofuel production (biodiesel or bioethanol) is among the big tests to livestock husbandry. The world experience in biofuel production has demonstrated that mostly commonly cereal crops (wheat, corn etc.) oilseeds (rape) and sugar crops (sugar beet and sweet sorghum) are used. The question is whether to use grain for bioenergy or for meat production. A very good estimate of available grain should be made in order to avoid the disturbance of bread and fodder balance.

➤ The better utilization of grain resources requires that it should not be exported in large amounts but to be used for the purposes of livestock breeding for better solution of food source problems and improvement of grain conversion.

➤ A complex strategy for utilization of plant resources and increasing the efficacy of their conversion into animal products is needed and this is considerably more profitable. The

reduction of the export and using the grain and the biomass for animal production purposes would decrease the import and subsequently increase the export rates. This would then result in improved trade exchange and increased competitiveness of the animal husbandry.

➤ Demographic problems and the continuous decrease in the number of people employed in animal husbandry are also a threat. Over a 10-year period – from 1997 to 2007, the population in the rural regions of Bulgaria has decreased from 2.674 to 2.254 billion – by 15.7% (Todorov, V. and D. Dohcheva, 2008). The poor living conditions and the low security of employment are reasons for decreased number of people employed in animal husbandry. The rural population is constantly migrating, especially that from semi-mountainous and mountainous regions. The ageing of population in rural regions is another problem for ensuring human resources for livestock breeding – 33-35% of the populations are over 65 of age, while employed people under 35 years of age are only 7.5-7.9%.

➤ The reluctance of young people to be employed in agricultural enterprises and animal production industry in particular, is very important challenge. The main causes are the difference in labour environment, the quality of life, the standard of living of rural and town populations, the lack of efficient infrastructure and modern communication systems. The shortage of financial resources, the slow rates of modernization in animal husbandry, the late introduction of internet and computer-based communications do not allow young people to use the latest achievements of information technologies in the sector.

➤ The stimulation of the young farmers and agricultural specialists is a challenge that would introduce innovations in the sector and strengthen the progress. For this purpose, European funds for subsidy of young farmers' training and realizations would be necessary. This would result in implementation of new technologies in animal husbandry.

➤ The technological updates and innovation in the livestock sector become more and more important for its prosperity. Another challenge is the creation and introduction of new breeds and hybrids, the modernization of production, human attitude to animals and the produced products diversification.

A main priority in the field of agrarian science and biotechnologies is the creation of European knowledge-based bio-economy – KBBE that is expected to respond to some primary social and economic challenges: sustainable production of foods, nutritional diseases, infectious animal diseases, agricultural production, fisheries and aquaculture, animal welfare.

The challenges to the Republic of Bulgaria in the field of livestock production are mainly related to creation of legislation providing equal fair conditions for all participants in the production, processing and trading of animal products. The state should assist the protection of rights of all parties along the chain: producers, processing enterprise owners, traders and consumers.

A challenge faced by the state is also the control on disloyal trade and the illegal import of low-quality, sometimes waste products of animal origin, as an obligation of the executive power is public health care.

## CONCLUSIONS

Bulgarian livestock husbandry continues to play an important role for procurement of population with foodstuffs, for food security and is a main source of income for people, particularly in rural regions which are essential in the economic crisis environment. There are several positive trends that result in improvement of the sector, as follows:

- the restructuring of the branch is going on in the direction of consolidation, which is adequate from strategical point of view. The share of farms rearing more animals is increasing on the account of the reduced proportion of small farms with few animals within;
- recategorization of production units with transition from a lower to higher category, which is essential for production of more high-quality animal production;
- modernization, construction of new farms and processing enterprises with modern equipment, ensuring more effective production and processing technologies to guarantee animal foodstuffs of higher quality;
- improvement of programmes for preservation of the genetic fund in livestock husbandry and perfection of selection programmes according to global economic and climatic changes
- larger size of close cycle animal farms with entire conversion (production, processing, marketing) of animal products;
- intensification of aquaculture, increased fish and fish products draughts;
- introduction of national standard for production of organic animal foodstuffs, with high quality and health effect for customers.
- improvement of the system for control (traceability) during animal food production and traceability throughout the conversion of production to ensure quality and healthy products to meet the increasing demands of consumers.

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## **ESTIMATE OF THE GENETICAL STOCK SILKWORM RACES FOR PARTHENOGENETIC DEVELOPMENT PREDISPOSITION**

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**Key words:** ameiotic parthenogenesis, thermic treatment, races, pigmentation.

### **SUMMARY**

The testing or the predisposition to ameiotic parthenogenesis of the ten silkworm races was done (J<sub>90</sub>, AC, AB, B<sub>75</sub>, B<sub>1</sub>, S<sub>8</sub>, V<sub>2012</sub>, V<sub>63</sub>, V<sub>65</sub>, V<sub>66</sub>). In order to induce the parthenogenesis two variants of thermic treatment have been applied, the work methods consisting in the following stages: extraction of eggs from ovarioles, their treatment at 46°C for 18 minutes, eggs preserving before and after thermic treatment.

The percent of normal eggs with complete pigmentation has represented the appreciation criterion for the races predisposition to pathenogenetic development. Its value has decreased during the eggs preservation; after 200 days of preserving, at the end of hibernation respectively, the percent of pigmented normal eggs was comprised between the limits 6.05-70.03%.

The following races have proved predisposition to parthenogenetic development: B<sub>1</sub>, S<sub>8</sub>, AB, V<sub>65</sub>, V<sub>66</sub>.

The parthenogenetic reproduction of the silkworm consists in the stimulation of the egg development by high temperature. Its citogenetical mechanism is explained by the disappearance of the meiotic reductional division. In the unfertilized eggs, stimulated in their development by the help of the warmth, the meiotic division is produced with more or less success and the diploid or poliploid maternal genotype is transferred unchanged to the pathenogenetic offspring (ASTAUROV, B.L., 1967, STRUNNIKOVA, L.V. et al. 1980, KLIMENKO, V.V. 1980). The individuals obtained in such way are in totality females.

Besides the scientific aspects connected with the embryonic development peculiarities of the individuals obtained by the parthenogenetic way, the method has a practical importance too. The resulted parthenogenetic generation is uniform from the genetical point of view and this characteristic is important in the reproduction and breeding of the species. This feature explains otherwise the recent studies concerning the parthenogenetic development of the silkworm. We mention the studies carried out in Bulgaria (VASSILEVA, Y. et al. 2001, 2002) out of which resulted that both methods of parthenogenetic induction and the peculiarities of the breeds influence the percentage of parthenogenetic individuals.

The similar researches were effectuated in Thailand (WILAI et al. 1994, 2002). According to the published results, the induction percentage of the parthenogenetic individuals was 78-87,5% and the average of the hatching percentage was 28,5-57%.

The hatching percentage of the parthenogenetic lines had low values, but these increased significantly in the hybrids obtained by crossing of parthenogenetic lines and the sexed reproduction breeds.

The selection of the parthenogenetic lines and their utilization to obtain commercial hybrids was the subject of the researches carried out by different authors (TAKAMI OHKOMA, 1971; VASSILEVA, Y. et al., 2004; WILAI et al. 1991; SINGH et al., 2002).

### 1. MATERIAL AND METHOD

The biological material used for testing the predisposition of the breeds for parthenogenetic development consisted of 10 silkworm races (J<sub>90</sub>, AB, B<sub>1</sub>, S<sub>8</sub>, V<sub>63</sub> – Japanes type and AC, B<sub>75</sub>, V<sub>65</sub>, V<sub>66</sub>, V<sub>2012</sub> – Chinese type). Twenty parthenogenetic lines were selected.

Two variants of treatment for obtaining pathenogenetic development were experimented, namely Astaurov method (method A) and a proper method (method B), the last one having some elements different from the techniques presented by other authors.

In the main, the experimental works consist in: extraction of the eggs from ovarioles or egg laying by unfertilized females, the egg washing before thermic treatment, the properly thermic treatment of the eggs in water (46°C) for 18 minutes, the egg washing in the tap water, the drying of the eggs on the filter paper, egg preservation after thermic treatment. The elements which differentiate the two methods refer to the preservation of the eggs before and after the treatment in hot water. In the method proposed by us, the eggs are preserved for 12 hours at 24-25°C before their dipping in hot water. After treatment the eggs were preserved for 4 days at 15-17°C, then they were maintained in favourable conditions for the estivation period.

In the stage of complete pigmentation the germination band is formed and in the embryonic development the diapause appears.

### 2. RESULTS AND DISCUSSIONS

The percent of normal eggs with full pigmentation has represented the appreciation criterion for the races predisposition to parthenogenetic development.

In the table 1 are presented results concerning the evolution of the percentage of the eggs with complete pigmentation. After 15 days from the thermic treatment, in the case of method A, the percentage of the eggs with complete pigmentation ranged within 32,97% (breed AC) – 62,35% (breed B<sub>1</sub>). A lower percentage 21,16-58,58% respectively, was registered in the following period (90 days from the treatment). The cumulate values of the

both determinations point out that after 90 days the total percentage of the pigmented eggs was placed in the limits 74,65% (breed V<sub>63</sub>) – 96,92% (breed B<sub>75</sub>).

In the period 90-200 days from the thermic treatment, which includes the hibernation period, the aspect of the pigmented eggs changed. They lost the turgor, dehydrated and dried. So, the counting effectuated after 200 days from the thermic treatment pointed out a percentage of normal, pigmented eggs placed in the limits 6,05% (breed S<sub>8</sub>) and 38,91% (breed B<sub>1</sub>).

In the table 2 are registered the results obtained in the testing of the races for parthenogenetic development predisposition using method B. Just after 15 days from the thermic treatment the percentage of the eggs with full pigmentation was higher by comparison with previous method, ranging in the limits 39,61 (breed AC) – 78,18% (breed B<sub>1</sub>).

The total percentage of the pigmented eggs, after 90 days from the treatment, reached maximum values (94,54%) in S<sub>8</sub> breed, followed by V<sub>2012</sub> (90,83%) and AC (89,64%).

The end of the hibernation period proved a visible diminution of the normal pigmented eggs percentage, making in the same time a different hierarchy of the races. In these last determinations, as in the preceding method, the highest percentage was in B<sub>1</sub> (70,03%) followed by S<sub>8</sub> (53,10%) and V<sub>66</sub> (51,70%).

The final results of the parthenogenetic development testing will be established after hatching percentage estimate.

### 3. CONCLUSIONS

1. Ten silkworm races (J<sub>90</sub>, AC, AB, B<sub>75</sub>, B<sub>1</sub>, S<sub>8</sub>, V<sub>2012</sub>, V<sub>63</sub>, V<sub>65</sub>, V<sub>66</sub>) were tested for parthenogenetic development predisposition.
2. Two variants of thermic treatment were experimented to induce parthenogenetic development; the methods involved the following works: extraction of the eggs from ovarioles or egg laying by unfertilized females, the thermic treatment of the eggs by their dipping in the hot water (46°C) for 18 minutes, the egg preservation before and after treatment.
3. The parthenogenetic development ability of the races was estimated by the percentage of the full pigmented eggs, with normal aspect referred to the total number of experimented eggs. The percentage decreased during the egg preservation, so that after 200 days from the treatment, at the end of hibernation period, the percentage of the normal pigmented eggs ranged in the limits 6,05-35,97% (method A) and 20,37-70,03% (method B).
4. The method used to induce parthenogenetic development influenced the results, the percentage of the pigmented eggs with normal aspect being higher in the case of method B.
5. The following breeds proved predisposition for ameiotic parthenogenetic development: B<sub>1</sub>, S<sub>8</sub>, AB, V<sub>65</sub>, V<sub>66</sub>.

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Table 1

**Percentage of ameiotic parthenogenetic development of some genetical stock silkworm races  
- Method A -**

Breed	Total treated eggs $X \pm Sx$	Eggs with full pigmentation vs total eggs			Percentage of parthenogenetic development			
		1-15 days after treatment	16-19 days after treatment	Normal eggs – 200 days after treatment	1-15 days after treatment	90 days after treatment	Total percentage 1-90 days	Percentage of normal eggs at the end of hibernation period (200 days after treatment)
J <sub>90</sub>	4081 ± 66	2410 ± 36	1058 ± 18	999 ± 24	59,07 ± 1,16	25,94 ± 2,06	85,01 ± 3,14	24,47 ± 1,20
AC	6047 ± 38	1993 ± 14	3541 ± 12	1383 ± 11	32,97 ± 1,20	58,58 ± 1,04	91,53 ± 2,22	22,87 ± 1,16
AB	7155 ± 42	3447 ± 12	3193 ± 16	2574 ± 8	48,18 ± 0,80	44,64 ± 3,40	92,82 ± 4,56	35,97 ± 0,98
B <sub>75</sub>	6402 ± 53	2971 ± 40	3233 ± 20	855 ± 12	46,42 ± 2,26	50,50 ± 1,12	96,92 ± 3,32	13,35 ± 0,66
B <sub>1</sub>	4417 ± 18	2753 ± 16	1404 ± 18	1719 ± 6	62,35 ± 1,14	31,79 ± 1,26	94,14 ± 1,80	38,91 ± 1,02
S <sub>8</sub>	4458 ± 32	2252 ± 10	2015 ± 14	270 ± 3	50,53 ± 1,08	45,22 ± 2,20	95,75 ± 2,06	6,05 ± 0,18
V <sub>2012</sub>	3530 ± 18	1709 ± 8	1527 ± 26	532 ± 16	48,41 ± 2,12	43,26 ± 1,85	91,67 ± 2,12	15,07 ± 0,86
V <sub>63</sub>	5840 ± 26	3124 ± 28	1236 ± 18	978 ± 12	53,43 ± 1,12	21,16 ± 2,18	74,65 ± 1,96	16,74 ± 1,02
V <sub>65</sub>	5716 ± 30	2607 ± 12	1786 ± 45	1312 ± 10	45,60 ± 1,08	31,26 ± 3,10	76,86 ± 2,88	22,95 ± 1,16
V <sub>66</sub>	5032 ± 15	2435 ± 8	1424 ± 11	1416 ± 26	48,40 ± 2,12	28,30 ± 1,28	76,70 ± 1,92	28,13 ± 1,18

Table 2

**Percentage of ameiotic parthenogenetic development of some genetical stock silkworm races  
- Method B -**

Breed	Total treated eggs $X \pm Sx$	Eggs with full pigmentation vs total eggs			Percentage of parthenogenetic development			
		1-15 days after treatment $X \pm Sx$	16-19 days after treatment $X \pm Sx$	Normal eggs – 200 days after treatment $X \pm Sx$	1-15 days after treatment $X \pm Sx$	90 days after treatment $X \pm Sx$	Total percentage 1-90 days $X \pm Sx$	Percentage of normal eggs at the end of hibernation period (200 days after treatment)
J <sub>90</sub>	3139 ± 21	1646 ± 16	810 ± 30	789 ± 14	52,43 ± 3,20	27,26 ± 1,83	79,69 ± 2,20	25,13 ± 0,77
AC	5336 ± 18	2114 ± 31	2670 ± 15	1112 ± 26	39,61 ± 4,36	50,03 ± 2,54	89,64 ± 3,36	20,83 ± 1,36
AB	6338 ± 38	3403 ± 15	1606 ± 10	2906 ± 13	53,62 ± 2,28	25,37 ± 3,10	79,06 ± 2,88	45,85 ± 1,18
B <sub>75</sub>	5696 ± 22	2861 ± 16	2020 ± 22	1985 ± 20	50,22 ± 3,36	35,46 ± 1,08	85,68 ± 3,44	34,84 ± 1,44
B <sub>1</sub>	5170 ± 42	4042 ± 18	514 ± 6	3621 ± 28	78,18 ± 2,62	9,94 ± 2,56	88,12 ± 2,48	70,03 ± 2,06
S <sub>8</sub>	3465 ± 36	2295 ± 12	981 ± 10	1840 ± 12	66,23 ± 1,06	28,31 ± 1,14	94,54 ± 1,10	53,10 ± 1,08
V <sub>2012</sub>	2120 ± 26	1032 ± 11	894 ± 6	432 ± 6	48,67 ± 2,20	42,16 ± 1,04	90,83 ± 1,66	20,37 ± 0,96
V <sub>63</sub>	3083 ± 18	1670 ± 14	703 ± 6	1055 ± 10	54,16 ± 1,20	22,80 ± 0,98	76,96 ± 1,14	34,21 ± 1,15
V <sub>65</sub>	3259 ± 28	1815 ± 10	1090 ± 11	1436 ± 22	55,35 ± 2,46	33,21 ± 1,82	88,56 ± 2,10	44,06 ± 1,44
V <sub>66</sub>	3350 ± 16	2059 ± 9	843 ± 6	1732 ± 35	61,46 ± 1,80	25,16 ± 1,18	86,82 ± 1,53	51,70 ± 0,88

## GENETIC CHARACTERISTICS OF EGYPTIAN BUFFALO USING DNA MICROSATELLITE MARKERS

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**Key words:** Egyptian buffalo; microsatellite DNA; polymorphism.

### SUMMARY

To evaluate the genetic polymorphisms for DNA microsatellite markers of Egyptian buffalo, 471 unrelated Egyptian buffalo were genotyped with 11 microsatellite markers. The data were analyzed with GenALEX6 software. The nine (82%) of microsatellite markers were polymorphic and the two (18%) were monomorphic. A total 198 alleles were detected, with the number of alleles per marker ranging from 17 (RM28 and BM415) to 29 (BMC4203), giving a mean number of  $22 \pm 1.302$  alleles per marker. The effective number of alleles was lower than the observed values with a mean value of  $16.502 \pm 1.137$  per marker. The most frequent alleles were ranged from 0.086 (BMC4203) to 0.127 (BM415).

The mean observed and expected homozygosity was 0.113 and 0.063, respectively, while observed and expected heterozygosity was 0.887 and 0.937, respectively, over all loci. Polymorphism information content values were ranged from 0.909 (BM415) to 0.949 (ILSTS093 and ILSTS097). At the nine microsatellite loci, the mean of fixation index was 0.052. Successful genotyping of Egyptian buffalo using these DNA microsatellite markers suggests that the latter can be a valuable resource for genome analysis in Egyptian buffalo.

The Egyptian buffalo (*Bubalus bubalis*) contributes significantly to the agricultural economy and food security in Egypt. Also, Buffalo is the main dairy animal in Egypt, in addition to being an important source of red meat. Annual milk and meat production from buffaloes are 2,640,638 and 169,013.57 ton respectively, contributing to 49 and 40% from total national milk and meat production in Egypt, respectively (MALR, 2008). Genetic maps provide new insights into genome structure and chromosomal architecture of the genome, and also serve as framework for identification and location of genes linked with economically important traits. Except for water buffalo, the genetic maps have been reported for most of the important livestock species. To develop genetic maps of water buffalo, identification and characterization of polymorphic microsatellite markers is prerequisite (Nagarajan et al., 2009).

DNA markers-based technologies enable the detection of different polymorphic types. Among those, microsatellites or short tandem repeats (STRs) or simple sequences repeats (SSR) have been identified in all the eukaryotic species that have been investigated thus far (Ron et al., 1996). The use of microsatellites in population genetics has so far been mainly reported in buffalo population (Zhang et al., 2007; Kumar et al., 2006 and Van Hooft et al., 2002).

Several studies had shown that repeated flanking sequences of microsatellite markers are often conserved between related species, allowing cross-species amplification (Schlotterer et al., 1991; Moore et al., 1994; Kemp et al., 1995; Levin et al., 1995; Moore

et al., 1995; Liu et al., 1996 and Primmer et al., 1996). These markers can be used in the characterization of species populations, genetic diversity (Esmailkhanian and Banabazi, 2006) and population studies (Arora et al., 2004 and Amirinia et al., 2007), as they are hyper variable and widely dispersed through genome. Moreover, they have application in the identification of individuals and parentage testing (Marklund et al., 1994 and Luikart et al., 1999, Seyedabadi et al., 2006 and Bhuyan et al., 2010).

Researchers had applied cattle microsatellite markers for defining the genome make up in buffalo because no systematic studies have been under taken to develop polymorphic DNA markers specific to this species (Shokrollahi et al., 2009). Hassanane et al., (2007) indicated that the successful genotyping of bovine microsatellites in the Egyptian buffalo genome.

Genetic characterization of each breed is necessary for its effective and meaningful improvement and conservation (Sajid et al., 2007). So, it is essential to characterize buffalo at the molecular level for their effective use in the genetic improvement programs (Saifi et al., 2004).

The purpose of the present study was to reveal the genetic polymorphisms of Egyptian buffalo using 11 DNA microsatellite markers.

## 1. MATERIAL AND METHOD

### **SELECTION OF BUFFALOES AND BLOOD SAMPLE COLLECTION:**

A total of 471 unrelated multiparous lactating buffaloes (Different families having no blood relation) represented seven different farms in six different governorates were utilized in this experiment. Also, there was no pedigree information available on these animals. A volume of 10 ml peripheral blood was collected from the jugular vein in Falcon tubes supplied with proper amount of EDTA. Field blood samples (471) were placed on a cooling gel in an ice box immediately after their collection and brought to the Animal Biotechnology Lab., established by a grant no.218, financed by Science and Technology Development Fund (STDF) and located in Faculty of Agriculture, Cairo university, Giza, Egypt and stored temporarily at -20°C before DNA extraction.

### **DNA EXTRACTION:**

DNA was isolated from the peripheral leukocytes using Fermentas® kits, Cat. No. k0512, Fermentas Life Science, EU, according to Sambrook and Russel, 2000.

The Yield, concentration and purity of DNA of the samples were quantified using ScanDrop® 200, Anytikajena, UK. The whole genome of each sample was runed in 0.8% agarose gel through a horizontal gel electrophoresis system (mini gel, Biometra® EU). Standard DNA/DNA ladder was used and all samples were brought at same concentration level (50 ng/ µl).

### **MICROSATELLITE DNA MARKERS SELECTION:**

Microsatellite DNA markers are 2- 6 nucleotide repeats, (simple sequence repeats) inter-spread throughout the genome.

Microsatellite DNA markers are highly polymorphic and abundant often found in noncoding region of genes (Rohrer et al., 1998). A total of 11 Microsatellite DNA

markers located in chromosome 7 in buffalo were utilized. The information about these DNA markers is given in Table 1.

#### AMPLIFICATION OF MICROSATELLITES MARKERS AND GENOTYPING:

The PCR was carried out on 50 ng of the genomic DNA in a 20 µl reaction volume of 50 mM KCL, 10 mM Tris-HCl (pH 8.8), 200 µM dNTP, 1.5 mM MgCl<sub>2</sub>, 5 Pmol of each primer and 1.0 U Taq DNA polymerase. The amplification was realized using thermal cycler (G-Storm®, Gene Technologies, UK) machine. The primary denaturation was done at 95 °C for 3 minutes followed by 10 cycles of denaturation at 94°C for 30 sec., the annealing temperature at 58.5- 59.5 °C (decrease in temperature set 1 °C after each cycle) for 30 sec. and the extension at 72 °C for 45 sec. Following these cycles with variant annealing temperatures (Table 1.), 30 cycles with constant annealing temperature at 54 °C were performed and reaction ended with final extension at 72 °C for 5 minutes and final storage temperature of 4 °C.

#### DATA ANALYSIS:

The GenALEX version 6 package software (Peakall and Smouse, 2006) was employed to calculate allele frequencies and sizes, effective number, observed and expected heterozygosity, and fixation index. Polymorphic information content was estimated using R program (2011).

Table 1

**Characterization of the relevant DNA microsatellite markers in chromosome six in cattle**

Marker Name	Physical map name	Primer sequence	Annealing Temperature	Minimum Allele size(bp)	Maximum Allele size (bp)	No. of alleles in cattle
ILSTS93	D6S22	TGAAATATACCTGAGTAGCAGC TTGTTTAACTCCCCACCCC	58.7 °C	179	202	19
BM1329	D6S14	TTGTTTAGGCAAGTCCAAAGTC AACACCGCAGCTTCATCC	58.7 °C	137	161	9
BM143	D6S13	ACCTGGGAAGCCTCCATATC CTGCAGGCAGATTCTTTATCG	58°C	90	122	13
BM415	D6S10	GCTACAGCCCTTCTGGTTTG GAGCTAATCACCAACAGCAAG	54°C	141	173	15
RM28	D6S4	CTACAGTCATGGGTCTGAAAGAG ATCTTCAGCCTGGCCTGAGAG	62°C	94	110	5
BMC4203	D6S20	GCAAATGTAAGCTGAAGGCC CCTGGGAAATCCCATGGAC	60°C	144	170	10
ILSTS97	D6S23	AAGAATTCCTGCTCAAGAGC GTCATTTCACCTCTACCTGG	58°C	234	244	3
AFR227	D6S18	GACCAACTGAGTGCATGCACG TCATTGAGCAGGAGTAGGATTGAG A	58°C	96	120	11
BMS483	D6S51	GGTATGAGACCAGGTGTGGG CAGGGCCACATTCCAAG	56°C	109	117	5

## 2. RESULTS AND DISCUSSIONS

Nine (82%) of studied markers were polymorphic and the two (18%) were monomorphic of 471 unrelated Egyptian buffalo. Nagarajan et al., (2009), stated that a total of 571 microsatellite markers have been characterized for water buffalo, they found that among the amplified cattle markers, 85% of the markers were polymorphic, this percentage was in agreement with our study, and slightly high when compared with the other studies on water buffalo (Moore et al., 1995 and Navani et al., 2002). Navani et al. (2002) reported that 56% of cattle microsatellite markers provided polymorphic band patterns when tested in 25 buffaloes. Results of the amplification of the bovine microsatellite in buffalo and sheep genomes may be referring to the sharing of a common ancestry for cattle, buffalo and sheep after the divergence of subfamily bovine (*Bos Taurus*) from the family bovinina (Mattapallil and Ali, 1999).

The number of alleles per locus ( $n_a$ ), effective number ( $n_e$ ) of alleles, observed ( $H_o$ ), expected ( $H_e$ ) heterozygosity, unbiased expected heterozygosity ( $U_H$ ), and allele size are shown in Table 2. A total of 198 alleles were detected with an average number of alleles per polymorphic locus was  $22 \pm 1.302$ , ranging from 17 (RM28 and BM415) to 29 (BMC4203). Vijn et al., (2008) found that the number of alleles per locus ranged from 11 to 26 allele on Indian water buffalo. Also, Weibin et al., (2007) reported that a total of 247 alleles were detected with the number of alleles ranging from 13 to 33, giving a mean number of 21 alleles per locus in Qinchuan cows. These differences in the number of alleles are due to the type of breed studied and the genetic polymorphism within the breed itself (Vallejo et al., 2003).

The average number of effective ( $n_e$ ) alleles per locus was  $16.502 \pm 1.137$ . Observed heterozygosity ( $H_o$ ) varied from 0.517 (ILSTS097) to 0.995 (BM143), while expected heterozygosity ( $H_e$ ) varied from 0.916 (BM415) to 0.952 (ILSTS093). The overall mean of  $H_o$  and  $H_e$  values were  $0.887 \pm 0.048$  and  $0.937 \pm 0.004$ , respectively. These results are in agreement with the study of Aminafshar (2008), who concluded that there were high mean percentages observed heterozygosity in three populations of Iranian buffalo using 15 cattle microsatellite.

Takezaki and Nei (1996) reported that average heterozygosity must be between 0.3 and 0.8 in a population, in order to be a useful marker tool for measuring the genetic variation. Our results for mean heterozygosity were higher than that range. Therefore, the identified markers in this study are suitable tool for measuring the genetic variation.

Movahedin et al., (2010) reported that the prevalence of fully heterozygote loci could be relevant to small size of studied sample population. Also, the main reason for the high level of observed heterozygosity could be because of one of the properties for economical population in a breeding program under intense selection in comparison with native population.

Aminafshar et al., (2008) reported that the excess of heterozygote individuals than homozygote individuals, association of loci with some genes of economics importance, migration and high mutation rate of microsatellite may be the cause. Mirhoseinie et al., (2005) concluded that the obtained results from heterozygosity indicated that the loci with more alleles contain higher rate of heterozygosity in both cattle and buffalo species.

At every microsatellite locus, allele size range was distinctive (Table 2). And at every locus, there was a most frequent allele (Table 3). At BM415 and RM28, the most frequent allele was 139 and 102 bp, respectively, which had an allele frequency of 0.127 and 0.122, respectively.

Table 2

Genetic estimates for the Egyptian buffalo

Microsatellite markers	N	na	Ne	Ho	He	Allele size (bp)
RM28	471	17	12.671	0.870	0.921	94-126
BM415	436	17	11.841	0.975	0.916	129-161
BM143	373	19	14.059	0.895	0.929	100-136
BM1329	323	24	17.943	0.994	0.944	123-169
AFR227	449	21	15.809	0.911	0.937	90-130
BMC4203	446	29	20.141	0.951	0.950	136-192
ILSTS093	179	24	20.698	0.899	0.952	183-229
ILSTS097	203	24	20.375	0.517	0.951	220-266
BMS483	393	23	14.976	0.972	0.933	100-144
Mean	364	22	16.502	0.887	0.937	--
SE		1.302	1.137	0.048	0.004	--

N = number of samples per marker; na =Number of different alleles; ne= number of effective alleles; Ho= Observed heterozygosity; He= Expected heterozygosity.

Polymorphism information content (PIC), fixation index (F) and Shannon's information index (I) in Egyptian buffalo genome was shown in table 3. Polymorphism information content (PIC) was estimated using allele frequencies in each polymorphic microsatellite locus, ranged from 0.909 (BM415) to 0.949 (ILSTSO93 and ILSTSO97), and mean PIC was 0.933. The PIC is a parameter indicative of the degree of informative of a marker and another important measure of DNA polymorphism. The PIC reflects the probability that a given offspring of a parent carrying a rare allele at a locus will allow deduction of parental genotype at a locus (Babar et al., 2009). Genetic markers with PIC values of less than 0.25 are considered to be less informative and those with values more than 0.5 are reckoned as distinctly informative in population genetic studies (Botstein et al., 1980). Loci with many alleles and a PIC near one are most desirable (Botstein et al., 1980). Following the criteria of Botstein et al., (1980), in this study, all the nine microsatellite loci appeared to be highly informative (PIC>0.5) and thus will be useful to evaluate the genetic diversity in Egyptian buffalo.

Fiona and Tracey (1998), reported that the PIC values are generally slightly smaller than heterozygous values, if large numbers of unrelated animals are genotyped. The number of unrelated animals used to calculate these values does vary and thus reverse the trend that PICs are slightly lower than heterozygous values. This is in agreement with our study.

The fixation indices of BM415, BM1329, BMC4203 and BMS483 microsatellite loci were negative and the others were positive (Table 3). The mean of fixation indices was 0.052, reflecting that the degree of heterozygote defect at these loci was high.

Table 3

**Most frequent alleles and their frequencies, Polymorphism Information Content (PIC) and Fixation Index (F) of Egyptian buffalo.**

Microsatellite markers	Allele	Frequencies	PIC	F
RM28	102	0.122	0.916	0.055
BM415	139	0.127	0.909	-0.065
BM143	110	0.113	0.924	0.036
BM1329	135	0.088	0.941	-0.052
AFR227	112	0.104	0.933	0.028
BMC4203	156	0.086	0.948	-0.0003
ILSTS093	195	0.064	0.949	0.055
ILSTS097	236	0.076	0.949	0.056
BMS483	116	0.111	0.929	-0.042

In conclusion, this study declared that a large fraction of bovine DNA microsatellite markers can be amplified and is polymorphic in Egyptian buffalo. Also, these DNA markers are applicable for population genetic studies on Egyptian buffalo.

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**THE EFFECTS of FENUGREEK (*Trigonella foenum graecum L.*) SEEDS on the PERFORMANCE and SOME CARCASS TRAITS of QUAIL (*Coturnix coturnix japonica*) CHICKS**

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**Key words:** Fenugreek, quail, body weight, feed conservation ratio, carcass traits.

**SUMMARY**

The purpose of this study was to establish the effects of fenugreek (*Trigonella foenum graecum L.*) seeds on the performance and some carcass traits of quail (*Coturnix coturnix japonica*) chicks. A total of 350 day old quail chicks randomly divided into 7 groups consisting of 5 replicates of 10 chicks each. Chicks were fed increasing levels (0, 0.5, 1, 1.5, 2, 2.5 and 3%) of Fenugreek for a period of five weeks. Diets were isonitrogenous (24% crude protein) and isocaloric (2903 kcal/kg diet). There were no significant differences among treatment for body weight, weight gain and feed consumption. Negative effect were observed in the quails fed with the ration containing 3% fenugreek seed in respect of feed conservation ratio and carcass weight ( $p < 0.05$ ). Heart ratio, liver ratio and testis ratio were not significant in all groups. It was concluded from this study that fenugreek seeds can be used for quail chicks without any adverse effects up to level of 2.5 %.

Fenugreek (*Trigonella foenum graecum L.*) is annual plant in the family Fabaceae. The plant is cultivated in western Asia, northern Africa, southeastern Europe and other parts of the world as a semi-arid crop. Seeds and herbs of fenugreek are used as food, herbal medicine, livestock feed and green manure etc. As human food in Turkey, bastoorma is made with meat and spices that is included fenugreek seeds specially. Because of the smell of fenugreek are used more breeding stock than dairy animals. Fenugreek has potential as forage crop for ruminants because it contains high quality about protein, and offers the benefits of a legume in a crop rotation (Acar, 2000). Fenugreek grown at the Agriculture Canada Research Station in Kamloops was analyzed for its nutrient content and digestibility. When cut after 22 weeks of growth, it had 14 per cent protein and 73 per cent dry matter digestibility. According to the results of this research, fenugreek had a more sustained release of nitrogen in the rumen for cattle feeding and greater mass digestion than alfalfa. It also contained diosgenin, a growth and reproduction hormone. It was thought that the combined effects of high digestibility and diosgenin content of the fenugreek plant might result in improved growth rates and increased efficiency of feed utilization in beef cattle (Anonymous, 1998). Fenugreek plants have been used as livestock feed; they provide 16% to 18% protein. When Fenugreek seeds are used in animal nutrition, a good protein supply and sufficient vitamin E should be considered to compensate for the potential hemolytic effects of fenugreek sapogenins (Wynn and Fougere, 2007). Fenugreek seeds contain protein (27%), oil (7-10%) etc. (Akgül, 1973), so fenugreek seeds may contribute in relatively high nutrition content of the plant. Fenugreek plants in Turkey generally grow average 60 cm high. Acar (1995) obtained fresh weed yield from fenugreek and mixtures of

fenugreek and oat (28719.7 and 31035.9 kg/ha respectively) as a grown second crop after harvesting of cereal in 1994. Fenugreek seed yield was obtained average 1040-1360 kg/ha in 1992-93 years in Konya-Turkey (Sade *et al.* 1994). Fenugreek as a novel forage crop is considered as an alternative to the production of alfalfa in Canada (Alemu and Doepel, 2011). Fenugreek is annual plant that has a very different use. It is easy to grow. For these reasons, cultivation of fenugreek should be increased especially as animal feed.

The objective of this study was to determine the effect of fenugreek seeds on growth performance and carcass parameters in quail chicks.

### 1. MATERIAL AND METHOD

A total of 350 day old quail chicks randomly divided into 7 groups consisting of 5 replicates of 10 chicks each. Chicks were fed increasing levels (0, 0.5, 1, 1.5, 2, 2.5 and 3%) of Fenugreek seeds for a period of five weeks. Diets were isonitrogenous (24% crude protein) and isocaloric (2903 kcal/kg diet). Fenugreek seeds ground and mixed diets. Chicks were raised (5 pens/ group) in different pens with 10 chicks per 0.38 m<sup>2</sup>. During the 5 wk of growing, a grower diet was provided ad libitum their respective treatments diets (Table 1). Room temperature was set at 33°C. The photoperiod was 23 L/1D. Birds and feed were weighed weekly to determine body weight and feed intake, and to calculate the feed conservation ratio (FCR). On day 35, after 12 hours fasting, all birds were weighed individually and slaughtered. After slaughtered, the carcass, liver and testis were excised and weighed and their relative weights to live body weight were calculated.

Statistical analyses were performed using a one-way ANOVA with Minitab for Statistical Software (release 14). Differences between treatment groups were determined using Duncan's multiple range tests (Düzgünes *et al.*, 1983). The significant differences between means were obtained by MSTAT-C Range Program (1989) using Duncan's Multiple Range Test.

Table 1

Ingredients and analysis	Composition of experimental diets						
	Levels of Fenugreek Seed						
	0%	0.5%	1%	1.5%	2%	2.5%	3%
Corn, yellow (8.8%)	56.45	56.20	55.88	55.60	55.40	54.94	54.69
Soybean meal (48%)	40.41	40.10	39.90	39.60	39.24	39.10	38.80
Fenugreek seed (28.6%)	-	0.50	1.00	1.50	2.00	2.50	3.00
Limestone	1.15	1.15	1.15	1.15	1.12	1.12	1.12
Dicalcium phosphate	1.00	1.00	1.00	1.00	1.05	1.05	1.05
Salt	0.35	0.35	0.32	0.32	0.33	0.33	0.33
Vit-Min. Premix <sup>1</sup>	0.25	0.25	0.25	0.25	0.25	0.25	0.25
DL-Methionine	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Vegetable oil	0.30	0.36	0.41	0.49	0.52	0.62	0.67
Total	100	100	100	100	100	100	100
Calculated analysis <sup>2</sup>							
Crude protein (%)	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Metabolizable energy	2903	2904	2903	2904	2903	2903	2903

(kcal/kg)							
Calcium (%)	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Available phosphorus (%)	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Sodium (%)	0.16	0.16	0.15	0.15	0.15	0.15	0.15
Lysine (%)	1.34	1.34	1.35	1.35	1.35	1.35	1.35
Methionine + cystine (%)	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Threonine (%)	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Tryptophan (%)	0.30	0.30	0.30	0.30	0.30	0.30	0.30

<sup>1</sup> Provided per kilogram of diet; vitamin A, 12000 IU; vitamin D<sub>3</sub>, 2400 IU; vitamin E, 25.0 mg; vitamin K<sub>3</sub>, 4.0 mg; vitamin B<sub>1</sub> (thiamine), 3.0 mg; vitamin B<sub>2</sub> (riboflavin), 5.0 mg; vitamin B<sub>6</sub>, 8.0 mg; vitamin B<sub>12</sub>, 0.015 mg; niacin, 25.0 mg; calcium-D-pantothenate, 8.0 mg; D-Biotin, 0.05 mg; folic acid, 0.5 mg; choline chloride, 125.0 mg; manganese, 80.0 mg; iron, 60.0 mg; zinc, 60.0 mg; copper, 5.0 mg; iodine, 1.0 mg; cobalt, 0.2 mg; Selenium, 0.15 mg.

<sup>2</sup> Based on NRC (1994) feed composition tables.

## 2. RESULTS AND DISCUSSIONS

The effect of fenugreek seeds supplementation on body weight is shown in Table 2. From week 3, F6 group had lower body weight than C, F1, F2 and F3.

Table 2

**The effect of fenugreek seeds on body weight of quail chicks**

Groups	Week					
	0	1	2	3	4	5
C	8.78	27.42	76.46	103.70 <sup>a</sup>	135.30 <sup>ab</sup>	166.68
F1	8.72	26.96	76.18	102.10 <sup>a</sup>	141.04 <sup>a</sup>	167.34
F2	8.72	26.34	73.02	98.54 <sup>a</sup>	139.06 <sup>a</sup>	166.38
F3	8.76	25.92	74.34	101.43 <sup>a</sup>	138.19 <sup>a</sup>	160.74
F4	8.62	25.72	72.40	97.14 <sup>ab</sup>	135.92 <sup>a</sup>	164.30
F5	8.64	26.96	73.22	95.76 <sup>ab</sup>	133.68 <sup>ab</sup>	164.40
F6	8.74	26.74	70.28	88.20 <sup>b</sup>	125.04 <sup>b</sup>	152.75
P Value	0.630	0.516	0.069	0.001	0.005	0.066
Pooled-SD	0.157	1.453	3.244	4.920	5.790	7.710

<sup>a,b</sup> Means within a column with no common superscripts differ significantly.

C:Control; F1:0.5% Fenugreek seed; F2: 1% Fenugreek seed; F3:1.5% Fenugreek seed; F4: 2% Fenugreek seed; F5: 2.5% Fenugreek seed; F6:3% Fenugreek seed.

As indicated in Table 3, there were no differences ( $P > 0.05$ ) in body weight gain among groups in 1, 5 and 1-5 weeks. In week 2, F6 group had lower body weight gain than C and F1 groups. Our results are consistent with Sarica et. al. (2005) the finding that no significant differences were observed between herbal natural feed additives (thyme and garlic) and control in broiler chick performances for 42 days. On the other hand, Awadein et. al. (2010) stated that body weight gain significantly higher in 0.1 and 0.5% fenugreek seed group than the control in Manadrah hens at 16 week of age. Similarly,

Parlat et. al. (2005) stated that body weight gain was higher use of thyme essential oil group than control in quail chicks.

Table 3

**The effect of fenugreek seeds on body weight gain in quail chicks**

Groups	Week					
	1	2	3	4	5	1 to 5
C	18.64	49.04 <sup>a</sup>	27.23 <sup>a</sup>	31.62 <sup>b</sup>	31.38	157.9
F1	18.24	49.22 <sup>a</sup>	25.91 <sup>a</sup>	38.96 <sup>a</sup>	26.29	158.6
F2	17.62	46.68 <sup>ab</sup>	25.52 <sup>a</sup>	40.52 <sup>a</sup>	27.32	157.6
F3	17.16	48.42 <sup>a</sup>	27.09 <sup>a</sup>	36.75 <sup>a</sup>	22.55	152.0
F4	17.10	46.68 <sup>ab</sup>	24.74 <sup>a</sup>	38.78 <sup>a</sup>	28.38	155.7
F5	18.32	46.26 <sup>ab</sup>	22.54 <sup>ab</sup>	37.92 <sup>a</sup>	26.72	151.8
F6	18.00	43.54 <sup>b</sup>	17.92 <sup>b</sup>	36.84 <sup>a</sup>	27.71	144.0
P Value	0.543	0.009	0.001	0.02	0.13	0.066
Pooled-SD	1.438	2,352	3.194	3.642	4.367	7.72

<sup>a,b</sup> Means within a column with no common superscripts differ significantly.

C:Control; F1:0.5% Fenugreek seed; F2: 1% Fenugreek seed; F3:1.5% Fenugreek seed; F4: 2% Fenugreek seed; F5: 2.5% Fenugreek seed; F6:3% Fenugreek seed.

The feed consumption were not ( $P > 0.05$ ) affected by any of the groups in 1 to 5 weeks (Table 4). The results that we obtained are consistent with Sarica et. al. (2005) the finding that no significant differences were observed between herbal natural feed additives (thyme and garlic) and control in broiler chick performances for 42 days. At the other hand, our result does not agree with Parlat et. al. (2005) who found that feed consumption was higher use of thyme essential oil group than control in quail chicks. On the contrary, Awadein et. al. (2010) stated that the average feed consumption was significantly lower in 0.5% fenugreek seed than the control in Manadrah hens at 16 week of age.

Table 4

**The effect of fenugreek seeds on feed consumption of quail chicks**

Groups	Week					
	1	2	3	4	5	1 to 5
C	38.58	90.28 <sup>b</sup>	117.00	125.00 <sup>c</sup>	163.73 <sup>a</sup>	534.59
F1	36.08	91.13 <sup>ab</sup>	111.00	133.6 <sup>abc</sup>	158.16 <sup>a</sup>	529.95
F2	36.88	94.50 <sup>ab</sup>	116.06	141.6 <sup>a</sup>	161.58 <sup>a</sup>	550.66
F3	39.58	100.4 <sup>a</sup>	114.28	134.9 <sup>ab</sup>	154.74 <sup>a</sup>	543.97
F4	35.00	84.86 <sup>b</sup>	115.48	135.4 <sup>ab</sup>	164.04 <sup>a</sup>	534.76
F5	38.00	87.32 <sup>b</sup>	113.96	133.6 <sup>abc</sup>	143.10 <sup>b</sup>	515.96
F6	38.12	95.02 <sup>ab</sup>	114.32	129.7 <sup>abc</sup>	157.56 <sup>a</sup>	534.69
P Value	0.099	0.033	0.957	0.011	0.0001	0.197
Pooled-SD	2.480	7.09	8.75	6.20	6.20	19.54

<sup>a,b</sup> Means within a column with no common superscripts differ significantly.

C:Control; F1:0.5% Fenugreek seed; F2: 1% Fenugreek seed; F3:1.5% Fenugreek seed; F4: 2% Fenugreek seed; F5: 2.5% Fenugreek seed; F6:3% Fenugreek seed.

The effect of fenugreek seed on feed conservation ratio is summarized in Table 5. F6 group (3.74) was deteriorated to FCR in 1 to 5 weeks. There were no significant differences in other treatments. Sarica et. al. (2005) stated that no significant differences were observed between herbal natural feed additives (thyme and garlic) and control in broiler chick performances for 42 days.

Table 5

**The effect of fenugreek seeds on feed conservation ratio of quail chicks**

Groups	Week					
	1	2	3	4	5	1 to 5
C	2.08	1.85 <sup>b</sup>	4.29 <sup>b</sup>	4.01	5.24	3.39 <sup>b</sup>
F1	1.98	1.86 <sup>b</sup>	4.30 <sup>b</sup>	3.43	6.04	3.34 <sup>b</sup>
F2	2.11	2.03 <sup>ab</sup>	4.58 <sup>b</sup>	3.50	6.00	3.49 <sup>b</sup>
F3	2.32	2.08 <sup>ab</sup>	4.31 <sup>b</sup>	3.72	6.93	3.58 <sup>ab</sup>
F4	2.04	1.82 <sup>b</sup>	4.68 <sup>b</sup>	3.50	5.87	3.43 <sup>b</sup>
F5	2.07	1.89 <sup>b</sup>	5.14 <sup>b</sup>	3.53	5.46	3.41 <sup>b</sup>
F6	2.12	2.18 <sup>a</sup>	6.50 <sup>a</sup>	3.58	6.17	3.74 <sup>a</sup>
P Value	0.131	0.023	0.000	0.178	0.253	0.019
Pooled-SD	0.174	0.181	0.592	0.350	1.033	0.173

<sup>a,b</sup> Means within a column with no common superscripts differ significantly.

C:Control; F1:0.5% Fenugreek seed; F2: 1% Fenugreek seed; F3:1.5% Fenugreek seed; F4: 2% Fenugreek seed; F5: 2.5% Fenugreek seed; F6:3% Fenugreek seed.

There were no significant differences between control and fenugreek seed groups the relative weight of heart, liver and testis are shown in Table 7. The lower carcass was obtained in F6 than F2 and F3, but not differs than the other groups.

Table 7

**The effect of fenugreek seeds on the relative weights of some internal organs and carcass yields of the quails at 35 days of age**

Groups	% Body Weight			
	Carcass	Heart	Liver	Testis
C	73.95 <sup>ab</sup>	0.86	1.66	1.71
F1	73.69 <sup>ab</sup>	0.87	1.59	1.86
F2	75.54 <sup>a</sup>	0.83	1.59	2.33
F3	75.70 <sup>a</sup>	0.84	1.55	2.00
F4	74.76 <sup>ab</sup>	0.82	1.64	2.25
F5	74.49 <sup>ab</sup>	0.81	1.65	2.13
F6	72.59 <sup>b</sup>	0.82	1.82	1.98
P Value	0.038	0.902	0.658	0.311
Pooled-SD	2.758	0.137	0.404	0.716

<sup>a,b</sup> Means within a column with no common superscripts differ significantly.

C:Control; F1:0.5% Fenugreek seed; F2: 1% Fenugreek seed; F3:1.5% Fenugreek seed; F4: 2% Fenugreek seed; F5: 2.5% Fenugreek seed; F6:3% Fenugreek seed.

These results are partly compatible with Awadein et. al. (2010) stated that no significant differences between control and fenugreek seed treatments for carcass, liver and heart weight in Manadrah hens at 16 week of age.

### 3. CONCLUSIONS

The results of the present study showed that a fenugreek seed had no significant effect on the growth performance, feed consumption and the relative weights of hearth, liver and testis, except carcass traits. The authors suggest it needs more studies to conduct in fenugreek seeds effect on meat quality, sexual maturity in quails. It was concluded from this study that fenugreek seeds can be used for quail chicks without any adverse effects up to level of 2.5 %.

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**GENETIC MARKERS IN TWO PIG POPULATIONS**VASILE BACILA<sup>1</sup>, MONICA MARIN<sup>1</sup>, LIVIA VIDU<sup>1</sup>, DAN COLCERI<sup>2</sup><sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Bucharest, Faculty of Animal Science, 011464, Bucharest, Bdul Mărăști, nr. 59, sect. 1, Romania<sup>2</sup> Breeders Organisation of Holstein RO, Milk analyses lab, Romania**Key words** : genetic polymorphism, aggregate genotype, genetic structure**SUMMARY**

Knowing the importance of genetic polymorphism of biochemical structures we considered a study of the genetic characterization of a sample in a pig population, based on the information offered by the genetic polymorphism at pre-albumins and transferine loci and the analysis of the serum.

The interpretation of the electrophoregrams allowed us to conclude that each of the three loci expresses a pattern of simple alleles.

Consequently the analysis of the phenotypes, for each of the three loci simple alleles system was observed in the electrophoretic field, with three types of expressions, specific to the three types of genotypes for each locus.

The simultaneous study of the three loci corresponding to the three types of serum proteins shows differences in the ratio of participation of the genetic categories in the genetic structure

For Large white, regarding the aggregate genotypes, out of 27 possible combinations at the three loci, only 16 were expressed in the sample studied. The highest ratio is represented by the three times homozygotes on B genes.

Out of the 27 possible genetic combinations for the three loci we observed 15 categories in this study for Synthetic Line 345.

The highest ratio was expressed by the individuals with the genotype combination  $Pa^B Pa^B / Tt^B Tt^B / Am^B Am^B$ , that represent about a third of the population Synthetic Line.

**1. MATERIAL AND METHOD**

For establishing the types of *transferine* and *pre-albumine* at the analysed samples, we used the technique of vertical electro-phoresis, using polyacryl amidae as a migration support, the same technique as used by Meriaux J.C. (1992), adapted to the conditions in the bio-chemistry laboratory the Faculty of Biology of The University of Bucharest.

In order to emphasize the types of *serum amylasis* we used electrophoresis in starch gel, in a discontinuous system of buffers, as in Smithies (1955), adapted to the conditions in our laboratory.

The ranging of individuals – according to the loci of the studied proteins and the four analyzed traits – was established consequently the statistic determinations.

**2. RESULTS AND DISCUSSIONS**

The description of serum proteins variants served to the purpose of using them as genetic markers, in order to measure the degree of homogeneity of heterogeneity of the pig population analyzed.

## SYNTETIC LINE 345

The simultaneous study of the three loci corresponding to the three types of serum proteins shows differences in the ratio of participation of the genetic categories in the genetic structure (Figure 1).

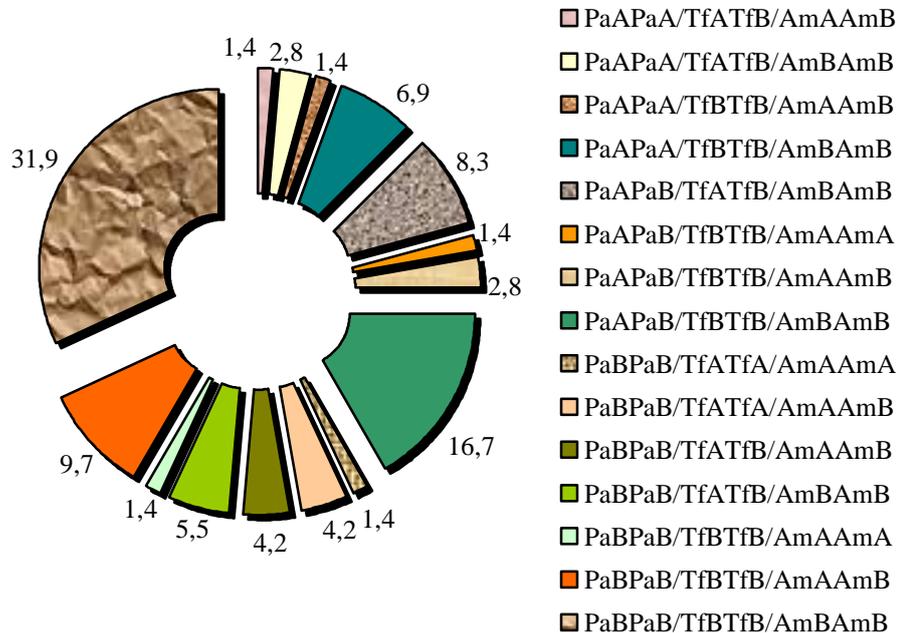


Figure 1. The distribution of aggregate genotypes at the loci of pre-albumins, transferrin and amylases(%),

The highest ratio was expressed by the individuals with the genotype combination  $Pa^B Pa^B / Tf^B Tf^B / Am^B Am^B$ , that represent about a third of the population studied. On the second place regarding the ratio of participation in the genetic structure, are the individuals expressing the pre-albumins AB, transferrin B and amylases B (16.70%). This comes as a consequence of the high frequency of the homozygote individuals  $Tf^B Tf^B$  at the locus of serum transferrin and homozygote for gene  $Am^B$  at the amylases locus. The high frequency of gene  $Pa^B$  – described for this sample – also contributed to the ratio of this category in the genetic structure of the population.

The least ratio of participation (1.40%) was recorded by the individuals that expressed at least an A type for one of the three serum proteins,  $Pa^A Pa^A / Tf^A Tf^B / Am^A Am^B$ ,  $Pa^A Pa^A / Tf^B Tf^B / Am^A Am^B$ ,  $Pa^A Pa^B / Tf^B Tf^B / Am^A Am^A$ ,  $Pa^B Pa^B / Tf^A Tf^A / Am^A Am^A$  and  $Pa^B Pa^B / Tf^B Tf^B / Am^A Am^A$ , respectively.

## LARGE WHITH

## GENETIC STRUCTURE

Consequently the analysis of the phenotypes, for each of the three loci simple alleles system was observed in the electrophoretic field, with three types of expressions, specific to the three types of genotypes for each locus (Table 1).

Table 1

The distribution of the genotypes at the loci Pa, Tf, Am

Locus	AA		AB		BB	
	N	%	N	%	N	%
Pre-albumines	2	2,6	27	35,6	47	61,8
Transferines	8	10,5	24	31,6	44	57,9
Amilasy	6	7,8	29	38,2	41	54

Regarding the aggregate genotypes, out of 27 possible combinations at the three loci, only 16 were expressed in the sample studied. The highest ratio is represented by the three times homozygotes on B genes.

The individuals homozygotes on B gene, at the loci of transferines and amylasis, and heterozygot at the locus of pre-albumines, are well represented too (13,2%).

Due to the fact that, in this sample, the heterozygote individuals  $Tf^A Tf^B$  represent one third of the total, the genotypes expressing these combination are better represented. Thus, the individuals  $Pa^B Pa^B / Tf^A Tf^B / Am^A Am^B$  and  $Pa^B Pa^B / Tf^A Tf^B / Am^B Am^B$  represent 9,2% each, out of the individuals that compose this population.

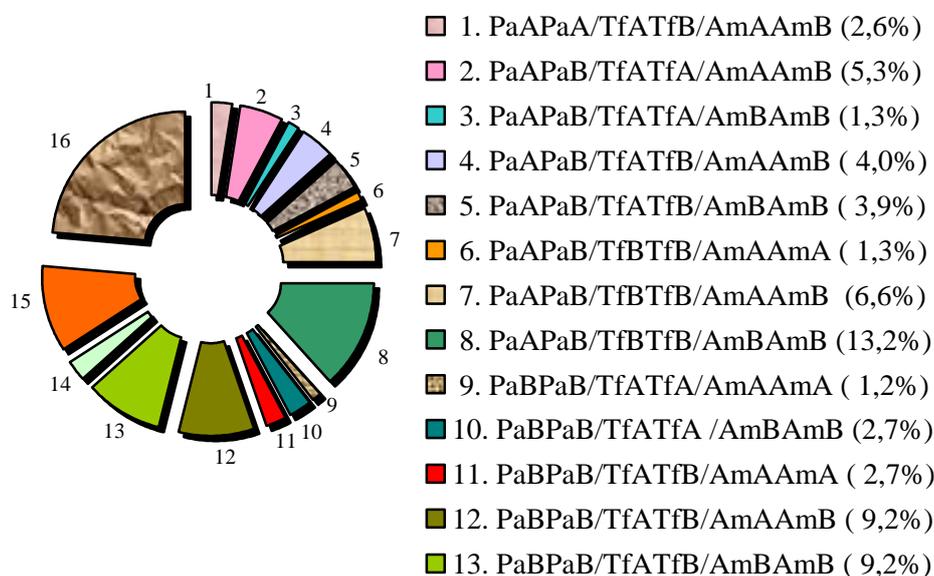


Figure 2. The distribution of the aggregate genotypes at the loci Pa, Tf, Am(%)

The least ratio of participation was recorded by the individuals that expressed the aggregate genotype  $Pa^A Pa^B / Tf^A Tf^A / Am^B Am^B$ .

### 3. CONCLUSIONS

1. The interpretation of the electrophoregrams allowed us to conclude that each of the three loci expresses a pattern of simple alleles.

2. Out of the 27 possible genetic combinations for the three loci we observed 16 categories in this study (Large whith) and 15 categories in Synthetic Line 345.

3. The least ratio of participation was recorded by the individuals that expressed the agregate genotype  $Pa^A Pa^B / Tf^A Tf^A / Am^B Am^B$  .(Large whith).

4. The least ratio of participation (1.40%) was recorded by the individuals that expressed at least an A type for one of the three serum proteins,  $Pa^A Pa^A / Tf^A Tf^B / Am^A Am^B$ ,  $Pa^A Pa^A / Tf^B Tf^B / Am^A Am^B$ ,  $Pa^A Pa^B / Tf^B Tf^B / Am^A Am^A$ ,  $Pa^B Pa^B / Tf^A Tf^A / Am^A Am^A$  and  $Pa^B Pa^B / Tf^B Tf^B / Am^A Am^A$ , respectively (Synthetic Line 345).

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## THE EFFECT OF BREED AND THE BODY CONDITION SCORE IN ECONOMIC TRAITS OF SHEEP

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**Keywords:** breed, body condition score, milk, birth & weaning, wool weights.

### SUMMARY

This study aimed to estimate the effect of breed and Body Condition Score (BCS) on the production economic traits of our sheep in Kurdistan region, Kurdi, Awassi and Mamesh sheep. The sheep were consisting of (53 Kurdi, 44 Awassi and 47 Mamesh) in Erbil / 2009. Results showed a significant effect of breed ( $p < 0.01$ ) on milk production, were highest in Mamesh. Moreover, wool, birth and weaning weights having already over taken Mamesh on Kurdi and Awassi. The study also showed that the (BCS) have significantly affected ( $p < 0.01$ ) on milk production, birth weights and wool. As the ewes (BCS) 3 and 4, has excellent in all the traits. Correlation between the (BCS) and average of milk production was highly significant ( $p < 0.01$ ) accounted to 0.295.

Livestock are an important factor in agricultural production as well as in securing sources of animal protein, which is a measure of the evolution of per capita food from the strategic of the development of livestock and the achievement of food security and self-sufficiency in livestock products. The body weight and growth rate are important economic traits, which are considered one of the basic components to increase the productivity of sheep including meat as well as to increase the flock sheep outcome [1]. Moreover, the wool of the three types of sheep is characterized as rough quality wool and with long fiber which covers almost the entire body. The study of economic traits for various animals in farm including sheep is very essential of serious education and plans for improvement. Furthermore, those economic traits are known as the clan members and they are varying in one different clans in the rate of production performance due to different combinations of genetic and environmental conditions. The objective of this study was to investigate the effect of different breeds between Kurdi, Awassi and Mamesh sheep and BCS in milk production, birth and weaning weights and weight of wool.

### 1. MATERIAL AND METHOD

The experimental of this study carried out with: (53) Kurdi sheep (44) Awassi and (47) Mamesh in 2009. The data were analyzed using the statistical method of General Linear Model (SAS) [2]. The ewes fed with residues of wheat and barley with concentrated feed (600-750) g / day / head and hay freely and water templates and salt

freely. Furthermore, all sheep were vaccinated and the used vaccinations were followed according to the preventive health program in each field.

## 2. RESULTS AND DISCUSSIONS

**MILK PRODUCTION:** The study of variation and genetic traits between breeds of the status of milk production Under any environmental conditions is important to determine the most appropriate breed that could be adapted to the circumstances of that particular environment, the mean of milk production 94.657 kg (table 1), results showed that the mean of breed (Kurdi, Awassi and Mamesh) were (88.254, 92.684 and 102.269) kg, respectively. The results indicate that the moral influence ( $p < 0.01$ ) for the breed in the mean of milk production is evident that the highest rate of milk production was in sheep Mamaesh 102.269 kg and the lowest in sheep Kurdish 88.254 kg (table 1) . However, the results did not show significant differences between the Kurdi and Awassi sheep. Furthermore, The results of this study were agreed with [3,4,5] . Ewes with the 4 recorded of (BCS) were the highest average of milk production and below the 102.883 kg milk production of ewes (BCS) 2, accounted to 86.391 kg. The results of this study were agreed with [6]. Correlation between the (BCS) and average of milk production was highly significant ( $p < 0.01$ ) accounted to 0.295. Ewes had a significant effect of age ( $p < 0.05$ ) in the mean of milk production as excelled ewes aged 3.5 and 4.5 years in the mean of milk production (100.727 and 103 906) kg, respectively on the other age groups The reason for increasing the productivity of milk ewes aged 3.5 and 4.5 years for 2.5 and 5.5 years traced to the development and integration of the Milk system which is responsible for milk production with increasing age, in addition to increase the weight of the mother as a result of increasing the size of the gastrointestinal tract and utilization of feedstuffs [5]. (table 1).

**BIRTH AND WEANING WEIGHT:** The results showed significant effect ( $p < 0.01$ ) of breed and (BCS) on birth weight (table 2), as characterized by the (BCS) of ewes 3 and 4 it gave the highest weight of infants at birth. The results of this study are identical with many of the studies on improving the productive performance of ewes to improve the (BCS) (4). The effect of breed had significant ( $P < 0.01$ ) in weight at weaning with (BCS), Kurdi, Awassi and Mamesh that weighted an average of 23.937, 21.556 and 27.612 kg, respectively [7,8]. The moral influence of the breed of this type is attributed variation in weaning weight to the variance in genotypes and the total weight of lambs at birth of the sheep Kurdi , Awassi and Mamesh 4.403, 3.968 and 4.885 kg, respectively, (table 2). Moreover, the age of the sheep had significant effect ( $p < 0.05$ ) in birth weight that reached peak at the age of (3.5, 4.5) years, accounted to (4.980 and 4.736) kg respectively [3,7,8]. In addition, these differences were significant, as characterized by (BCS) 3 and 4 and it gave the highest weight of infants at birth ( 4.805, 4.695 ) kg respectively , compared with ewes (BCS) (2) 3.976 kg (table 2). Weight at birth and the amount of milk lactation period [9,10].

**WOOL PRODUCTION:** results showed that the mean weights of wool shearing were 2.220 kg , 1.829 kg and 2.585 kg for breeds of sheep Kurdi, Awassi and Mamesh, respectively (table 3). Sheep weights have significant effect ( $p < 0.05$ ) on shearing

weights of wool reached a maximum at the age of 3.5 and 4.5 years, accounted from (2.735 to 2.660) kg respectively. Whereas produced ewes which weighed 60 kg more weight shearing heavier by 2.911 kg wool. Research found that the weight of the fleece begins with the increase of the ewes with the (BCS) (2) as the total weight fleece 1.387 kg up to 2.612 kg in ewes (BCS)(3) the state of the body and reaches a maximum (2.710) kg in the ewes with the (BCS) (4) (table 3). It was found that the correlation coefficient between the (BCS) and wool shearing weights has reached 0.430, ( $p < 0.01$ ). The results indicated there were significant differences ( $p < 0.01$ ) in weight of wool shearing, resulting from the impact of race, overtook sheep Mamesh weigh in shearing, wool on the Kurdi and Awassi due to the differences in weight of wool between the breed to the variance in each of the size of the animal's body and the ability of animals efficiency of feed conversion to wool [11] .

Table 1

**Least squares means  $\pm$  stander error of the impact of breed, (BCS) and age of sheep on the milk production (kg).** \* significant at .05 \*\* significant at .01

classification	no.	S.E $\pm$ milk production mean
overall Mean	144	94.657 $\pm$ 0.125
Breed		**
Kurdi	53	88.254 $\pm$ 0.386b
Awassi	44	92.684 $\pm$ 0.417b
Mamesh	47	102.269 $\pm$ 0.302a
BCS		**
2	48	86.391 $\pm$ 0.387c
3	56	95.083 $\pm$ 0.344b
4	40	102.883 $\pm$ 0.341a
age of dam(year)		*
2.5	43	83.256 $\pm$ 0.525b
3.2	35	100.727 $\pm$ 0.386a
4.5	33	103.906 $\pm$ 0.376a
5.5	33	84.242 $\pm$ 0.650b

The body weight as the economic traits is an important to breeders and that their importance in the production of wool because there is a positive relationship between body weight and weight of fleece raw because the increased size of the animal increases the surface area covered with wool. While the correlation coefficient between the weight of sheep when fleecing and weight moral ( $p < 0.01$ ) were accounted to (0.433), whereas the (BCS) had a significant effect ( $p < 0.01$ ) in weight shearing wool (table 3). This may be due to the increased size of the uterus, accompanied by the advancement of age of the sheep so that they can create an environment and conditions of the uterine best for the growth of the fetus.

Table 2

**Least squares mean  $\pm$  stander error birth and weaning weights (kg)**

\* significant at .05 \*\* significant at .01 n.s non significant

classification	no.	birth weight mean $\pm$ S.E	no.	weaning weight S.E $\pm$ mean
overall Mean	144	4.467 $\pm$ 0.022	144	24.625 $\pm$ 0.046
breed		**		**
kurdi	53	4.403 $\pm$ 0.020b	53	23.937 $\pm$ 0.115b
awassi	44	3.968 $\pm$ 0.023c	44	21.556 $\pm$ 0.136b
mamesh	47	4.885 $\pm$ 0.016a	47	27.612 $\pm$ 0.116a
BCS		**		n.s
2	45	3.976 $\pm$ 0.017b	45	22.940 $\pm$ 0.121a
3	49	4.805 $\pm$ 0.019a	49	25.649 $\pm$ 0.137a
4	50	4.695 $\pm$ 0.021a	50	25.533 $\pm$ 0.160a
age of dam(year)		*		*
2.5	37	4.021 $\pm$ 0.019b	37	23.018 $\pm$ 0.145c
3.2	38	4.980 $\pm$ 0.024a	38	26.286 $\pm$ 0.187ab
4.5	35	4.735 $\pm$ 0.035a	35	27.385 $\pm$ 0.251a
5.5	34	4.208 $\pm$ 0.027b	34	22.128 $\pm$ 0.185c

As the small age ewes are in the process of growth and development and thus affect the amount of food available for fetal growth and development .The findings come in line with [1].

Table 3

**Least squares mean  $\pm$  stander error of the impact of factors on the wool production (kg).**

\* significant at .05 \*\* significant at .01

Classification	no.	S.E $\pm$ wool production mean
overall Mean	144	2.238 $\pm$ 0.007
Breed		**
Kurdi	53	2.220 $\pm$ 0.020b
Awassi	44	1.829 $\pm$ 0.022b
Mamesh	47	2.585 $\pm$ 0.018a
BCS		**
2	54	1.387 $\pm$ 0.020b
3	45	2.612 $\pm$ 0.019a
4	42	2.710 $\pm$ 0.015a
weight of ewes at shearing(kg)		**
40 - 50	60	1.630 $\pm$ 0.016c

50 - 60	41	2.245±0.023b
60 ≥	43	2.911±0.018a
age of dam(year)		*
2.5	44	1.661±0.020b
3.5	38	2.735±0.024a
4.5	37	2.660±0.023a
5.5 ≥	25	1.977±0.050b

### 3. CONCLUSIONS

Effect of breed and Body Condition Score in economic traits was highest in Mamesh than Kurdi and Awassi sheep, (BCS) of ewes 3 and 4 it gave the highest weight of infants at birth. Correlation between the (BCS) and milk production was highly significant. The correlation coefficient between the weight of sheep when fleecing and weight moral ( $p < 0.01$ ) were accounted to (0.433).

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## CONSERVATION OF ROMANIAN BROWN BREED IN ORDER TO PRESERVE BIODIVERSITY

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**Key words:** Brown breed; productions, evolution

### SUMMARY

Brown Swiss Alpine breed or Brown breed was formed over 200 years ago in the Swiss Alps in the canton of Schwyz.

Brown breed is originally breed cattle populations brachicer type, over which cattle were overlapped to the Burgundians. On completion of the current type of mixed milk-meat production have contributed rigorous selection made over time, and favorable natural conditions and passion of Swiss farmers.

Over generations they have been set based on rac Brown inherited some outstanding individual qualities: strength, endurance, power adaptation, fecundity, longevity and a good capacity for recovery of feed volume.

These qualities have become characteristics typical of the breed very popular Brown, and in the shortest time, synonyms Brown breed cattle worldwide.

The aim of the current growth, which was fixed recently, once again gives priority to milk production, aiming to achieve a milk-meat mixed type, predominantly for milk production and good physical development.

The biodiversity describe the whole types of variability of living organisms in an ecological complex.

In the world is a tend to reduce the biodiversity, so between years 1980-2000, 145 species disappeared and many others are endangered.

Bruna de Maramures, from Romania, was formed by crossing the indigenous cattle with bulls from Swiss Alpine Brown breed.

Bruna de Maramures cattle are animals with mixed production , milk- meat, that live in submontane area, where capitalize very well the local forage resources, giving good milk and meat production, quantitative and qualitative better than improved breeds for milk production or for meat production can do in the same conditions.

It's necessary to stop the decline of this local breed, adapted to hard conditions of feeding and maintenance in submontane area.

### 1. MATERIAL AND METHOD

To perform this research, the A.N.A.R.Z. archives between years 2001- 2008 were studied with special attention, production data were extracted all cattle from Brown breed and were calculated all the parameters present in „ Discussions and results “ chapter.

Even if for 2009 and 2010 there are not data for official control, after the journey at Brown breed farm, and analyzing the documents from the farm, we can say that in those farms, for insemination of cows was used semen from Brown breed bulls, coming from trade between the Community.

## 2. RESULTS AND DISCUSSIONS

If we were to characterize the synthetic breed type morpho-Brown is mixed milk-meat production, format and development body eumetric rectangular body (waist 136 cm and weight of 600-650 kg per cow, respectively 152 and 1000 cm kg for bulls).

The head is short, broad, expressive type brachicer. The trunk is large, the upper horizontal line, square and muscular rump, long and open the chest (53.5%), big belly, udder is large, globular, well attached, with developed glandular tissue, nipple milking uniform and good mechanical skills.

Uniform brown color is white ring around the muzzle. It has a mild temperament lively, robust constitution, vitality, disease resistance and high capacity for adaptation, especially in mountainous areas.

In Romania, the breed was brought to Brown for the first time in 1881 in Maramures, the Austrian forest workers. Following adaptation to the conditions of the area and good results on production in coming years, increased demands from farmers and followed the massive imports of cows and bulls of the breed Schwyz, which had spread to all major forestry centers as Borsa, Viseu, Sighet Dragomiresti, Vad, Cîmpulung the Tisza.

Philip N. as mentioned, the results of Schwyz breed crosses with local breeds were better than those with Pinzgau and Simmental, which led the Ministry of Agriculture to import animals from Switzerland in 1908 and founded the Runcun tamazlâc to improve breed Brown.

Cradle of training in our brown race remains Maramures region, where its name comes Maramures Brown.

Can easily find, unfortunately, that the 1996-2010 study period, the total number of brown race is a continuous and pronounced decrease, just as evidence or data contained in table 1.

Decrease very rapidly, within 15 years, Brown-breed herd of cattle census, from 822,985 to only 427,066 head ends, ie more than 48% is a warning and a challenge for all specialists in animal husbandry, which have a duty to make common cause to achieve and implement a conservation program of Maramures Brown breed, the breed can and should contribute to the achievement of sustainable agriculture and preserving balance in rural areas of Romania.

Table 1

**Manufacturing performance achieved in the area of growth for the Brown breed  
(2008) (Source ANARZ) [1]**

County	Race	<u>Total current</u>			
		No.	Milk	F	a <sub>t</sub>
				%	kg
ARGES	B	175	3596	3,69	132,69
	BNR	76	4069	3,84	156,24
BACĂU	B	902	3125	3,77	117,81
	BNR	281	4365	4,03	175,09
BUZĂU	B	227	3678	3,68	135,35
	BNR	775	4323	3,69	159,51
DÎMBOVIȚA	B	14	5856	3,63	215,57
	BNR	296	6384	3,86	246,42
GORJ	B	1371	4138	3,77	156,00
	BNR	392	4668	3,78	176,45
MARAMURE	B	741	4008	3,96	158,71
	BNR	39	4847	3,77	182,73
MEHEDINȚI	B	671	4149	3,75	155,58
	BNR	476	4894	3,72	182,05
NEAMȚ	B	462	4459	3,83	170,77
	BNR	248	4751	3,85	189,91
PRAHOVA	B	166	4013	3,72	149,28
	BNR	324	6676	3,65	246,67
VÎLCEA	B	1351	3879	4,02	155,93
	BNR	0	0	0	0
VRANCEA	B	464	4077	3,97	161,85
	BNR	595	6195	3,95	244,70

B- Brown

BNR- Baltata Romaneasca

## 2. GENETICS AND BREEDING

Table 2133

**Inventory Brown breed in the area of growth between 1996-2010 (heads) [1]**

	County	Year							
		1996	2000	2005	2006	2007	2008	2009	2010
<b>Tota</b>		<b>82298</b>	<b>682903</b>	<b>60717</b>	<b>57939</b>	<b>573926</b>	<b>52086</b>	<b>46829</b>	<b>42706</b>
1	Alba	0	140	120	145	132	36	55	59
2	Arad	1123	562	756	494	888	709	283	257
3	Arges	82300	80478	71887	70329	73273	62609	57320	47487
4	Bacau	74664	66513	59688	57362	59188	53542	49054	44619
5	Bihor	279	634	272	159	175	154	185	161
6	Bistrita	11069	9371	6853	6800	6181	6406	6162	5015
7	Botosani	400	48	0	0	14	0	70	60
8	Brasov	4410	7266	6845	7315	7389	6780	6620	6432
9	Braila	648	303	234	304	142	0	0	0
10	Buzau	34965	28475	30017	25103	28705	25732	22530	21029
11	Caras-	460	933	165	0	0	0	3000	2100
12	Calarasi	775	927	133	93	71	35	0	0
13	Cluj	130	343	391	344	380	531	184	369
14	Constant	0	0	1580	865	985	825	480	370
15	Covasna	0	250	318	401	210	0	0	0
16	Dambovi	66760	30248	45471	42638	41011	34671	28088	24226
17	Dolj	21184	21654	5833	6022	3409	3026	2744	1844
18	Galati	8756	4616	82	516	637	126	490	396
19	Giurgiu	11249	7346	2597	0	130	100	0	0
20	Gorj	47541	45963	43719	41688	38439	35157	30230	28649
21	Harghita	0	0	0	0	0	0	0	62
22	Hunedoa	500	267	72	389	679	766	630	1026
23	Ialomita	4515	4818	881	901	838	999	844	786
24	Iasi	20200	15461	9569	9944	9104	7382	6099	5931
25	Ilfov	3181	3279	2290	2452	1956	1400	1500	1204
26	Maramu	73260	60194	48392	46881	46020	51411	43548	43423
27	Mehedin	21993	20938	18427	18694	19032	17273	15037	15005
28	Mures	120	13327	276	235	129	392	607	140
29	Neamt	68290	57810	50986	46778	46926	44486	42268	42379
30	Olt	27616	13716	7553	5683	4977	5403	2454	2070
31	Prahova	54162	46384	47757	40278	37478	32673	26221	23955
32	Satu	11521	12620	9502	9248	9426	9222	7824	7138
33	Salaj	144	703	650	548	470	276	187	162
34	Sibiu	719	61	154	230	172	150	116	82
35	Suceava	32059	29582	34863	35458	36853	35123	31757	29016
36	Teleorm	8928	2120	310	400	370	450	430	700
37	Timis	11657	0	93	33	33	31	45	55
38	Tulcea	100	127	0	0	0	0	770	0
39	Vaslui	21775	11774	8554	10427	9742	4976	4341	4012
40	Valcea	56997	50303	54388	52444	51375	43372	36908	34772
41	Vrancea	38535	33349	35493	37798	36987	34642	39218	32075

## 2. GENETICS AND BREEDING

As can be seen easily, the data presented in the table 3 and chart 2, normal number of lactations completed in one year decreased control, unfortunately, from year to year, while decreasing the number of animals that are listed in official control of production.

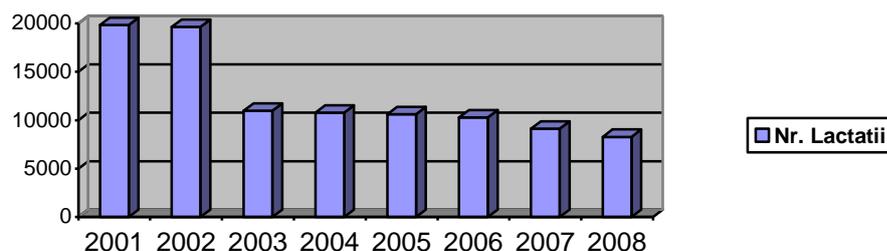
Regarding milk production achieved normal lactation, we can say that it greatly increased between 2001-2006, the result of selection and breeding work. The decline in the years 2007 and 2008 may be due to both climatic conditions in these years (prolonged drought) and official control of production output of farms with production of special (Ex. Farm Vlăsia).

Similar research done in sheep Ion Rosu[3].

Table 3

**Milk production (quantity of milk and fat) on normal lactating cows during the Brown-Schwyz breed 2001-2008 (Source ANARZ) [1]**

Year	Average yield of milk per lactation normal		
	No lactation	Milk	Fat
2001	19815	3299	124.00
2002	19630	3033	114.68
2003	10964	3860	150.00
2004	10769	4047	158.00
2005	10616	4214	166.0
2006	10276	4427	175.00
2007	9120	3725	146.00
2008	8283	3583	139.00



Even if the condition of feeding and maintenance is generally known as constraining factor for the manifestation of genetic potential, in such circumstances the Brown cattle shows, in some counties (Dambovită, Gorj, Neamț and Vrancea) their great adaptability to severe conditions and superiority Volume capitalize feed (pasture, hay) [2].

Although production is increasing year by year level achieved can not be compared with yields obtained by active populations of brown breeds bred in Europe (Switzerland, Austria, Germany, Italy, etc.). For the reasons mentioned above.

Even with yield of elite livestock farms do not reflect the genetic potential of the breed, as you can see above. Average milk yield of cows made of bull mothers is higher than the average achieved with the active population forming herds or farms elite.

Thus, in 2008 there is a difference between the average yields achieved by the mother cows, bulls, of 2591 kg to 1060 kg active population and leading to the farms. Here's a milk production in cows 8 years of bull mothers shown in the table below and clearly supports our statements.

Table 4

**MT milk production in cows, the Brown breed, from 2001 – 2008**  
(Source ANARZ) [1]

Year	No milk lactations	Milk (kg)	Fat	
			%	kg
2001	300	5209	3,91	203,67
2002	300	5538	3,79	210,00
2003	260	5894	4,05	239,00
2004	235	5882	4,00	235,00
2005	260	6251	4,00	250,00
2006	261	6393	3,99	255,00
2007	258	5809	4,00	232,00
2008	152	6174	3,90	243,00

Table 5

**Productive performance indicators on average mature equivalent (ME), body growing and (conformation) of mothers nominated cow bulls in 2007 - strong elite \***  
(Source ANARZ) [1]

Farm code	N	Average production (ME)						W kg	Waist		Exterior body score					
		L/ kg	G		P		HG		HS	Total	FO	IM	CPL	FU	U	
			kg	%	kg	%										
9270221	19	6493	253	3,89	214	3,18	631	136	137	86,9	22,1	8,7		21,6	34,4	
13940001	1	4248	194	4,57			580	132	137	88,9	22,1	9,1		22,3	35,3	
40370138	5	4369	196	4,49	139	3,12	520	136	138	86,2	20,8	8,8		21,9	34,8	
99210001	2	5010	195	3,90	164	3,17	618	134	138	83,2	21,5	7,7		21,2	32,9	
10517000	11	5283	201	3,81			476	135	138	85,2	21,6	7,8		21,6	34,2	

Table 6

**Productive performance indicators on average mature equivalent (ME), body growing and (conformation) of mothers nominated cow bulls in 2008 - strong elite**  
(Source ANARZ) [1]

Farm code	N	Average production (ME)						W kg	Waist		Exterior body score					
		L/ kg	G		P		HG		HS	Total	FO	IM	CPL	FU	U	
			kg	%	kg	%										
91040001	42	7082	270	3,81	209	3,05	620	138	137	87,2	22,2	8,6		21,6	34,8	

Tabel 7

**Productive performance indicators on average mature equivalent (ME) body growing and (conformation) for cows nominated mothers bulls in 2007 – the elite nucleus (Source ANARZ) [1]**

Farm code	N	Average production (ME)					W kg	Waist		Exterior body score					
		L kg	G		P			HG	HS	Total	FO	IM	CPL	FU	U
			kg	%	kg	%									
12350003	2	5677	236	4,17	167	2,9	645	137	138	88,3	22,3	8,9		22,1	35,0
66740005	1	6378	239	3,75	173	3,1	560	136	139	90,0	22,5	9,1		22,4	36,1
67950003	2	5250	214	4,07	156	2,9	555	132	134	87,9	22,4	8,5		22,0	35,0
89620185	40	7061	268	3,80	232	3,1	635	138	137	87,3	22,1	8,7		21,7	34,8
93050350	6	5702	236	4,14	196	3,1	616	137	139	84,3	21,3	7,1		20,9	35,0
99210136	3	4846	198	4,10	166	3,3	563	135	137	81,8	21,0	8,6		20,2	32,0
108720040	1	4936	199	4,03	122	2,7	610	135	137	85,9	21,9	8,5		20,6	34,9
108970003	3	4895	199	4,08	130	2,8	607	134	135	86,4	22,1	8,0		21,3	35,0
120810004	1	4464	187	4,20	143	3,2	600	132	134	84,4	20,9	7,7		21,9	33,9
138220003	1	4939	192	3,90	124	2,6	530	133	138	85,3	21,2	7,7		21,8	34,6

ME- dam

Table 8

**Productive performance indicators on average mature equivalent (ME) body growing and (conformation) of mothers nominated cow bulls in 2008 – the elite nucleus (Source ANARZ) [1]**

Farm code	N	Average production (ME)					W kg	Waist		Exterior body score					
		L kg	G		P			HG	HS	Total	FO	IM	CPL	FU	U
			kg	%	kg	%									
9270221	23	6476	251	3,87	204	3,17	611	136	137	87,1	22,2	8,8		21,7	34,3
120230002	1	5515	219	3,97	179	3,25	450	133	135	85,7	20,9	8,5		21,5	34,8
120810004	1	5005	206	4,11	160	3,38	560	132	134	86,2	22,2	7,7		21,9	34,5

W kg- body weight

HG- height at withers

HS- height at hipes

FO- body shape

IM- muscling

CPL- milk points conformation

FU- feet and leg

U- udder

In Tables 5-8, are presented "productive performance indicators on average mature equivalent (ME), body growing and (conformation) of mothers nominated for cows, bulls, farms and elite core between 2004-2008.

### 3. CONCLUSIONS

We believe that mothers –cows bull – presented today have very good milk production, the production of protein and fat also very good. There are also items that should and can be improved, factors such as weight, size. Nucleus farms and performance in elite and production value and score of the candidate mothers cows, bulls, entitle us to assert that Maramures Brown breed has a great potential for production that will have an important role in maintaining populated with cattle of the Carpathians.

It must, therefore, attaining the highest priority of a national program for conservation of Maramures Brown breed, to preserve and develop this local breeds, adapted, productive and indispensable for many mountain ranges and alpine pasture in Romania.

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## **PARTIAL RESULTS REGARDING THE GENETIC ANALYSIS OF GIDRAN HORSE FROM TULUCEȘTI STUDFARM: REPRODUCTIVE ISOLATION AND AGE STRUCTURE**

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**Key words:** Gidran, reproductive isolation, genetic structure.

### **SUMMARY**

This study is a part of an ample research concerning the genetic analysis (history) of Gidran horses from Tulucești studfarm. The genetic analysis studies are a part of Animal Genetic Resources Management because just start of them we elaborate the strategies for inbreeding management. This study has as purpose to present two important aspects of genetic analysis: reproductive isolation level and age structure. This parameters has a capital importance in animal breeding because there has a directly influence in animal population evolution.

The reproductive isolation situation was quantified using the relation elaborated by S. Wright in 1921.

The age structure situation is based on the age distribution histogram.

The analysis showed that the Gidran horse from Tulucești stud is not a reproductively isolated population with its own evolutionary path. Age structure is not balanced with negative repercussions on generation interval.

This study is a part of an ample research concerning the genetic analysis (history) of Gidran horses from Tulucești studfarm. The genetic analysis studies are a part of Animal Genetic Resources Management because just start of them we elaborate the strategies for inbreeding management [3]. This study has as purpose to present two important aspects of genetic analysis: reproductive isolation level and age structure. This parameters has a capital importance in animal breeding because has a directly influence in animal population evolution.

The population acceptance criteria are four: reproductive isolation, morphological and physiological differences, environmental requirements and genetic size [4]. The reproductive isolation level is the most important criteria for population acceptance, the other three being in according to them [1]. This parameter is very important because only reproductive isolated populations have an own evolution, in contrary they are influenced by evolving of immigrants populations.

The age structure have a double importance: for exploitation because influenced directly average age, and on the other hand, for animal breeding because is influenced the generation interval and population variability [2].

## 1. MATERIAL AND METHOD

The biologic material are represented by four sire stallions and 26 mares Gidran, representing the entire reproductive nucleus from Tuluțești stud farm at this time (05.12.2010).

The reproductive isolation level was quantified using the follow relation [1]:

$$C.I.R. = \frac{AA - (AI + II)}{AA + AI + II},$$

where: AA – number of individuals accepted for reproduction in analysed interval with both autohtones parents; AI – number of individuals accepted for reproduction in analysed interval with one autohtone and one immigrant parent; II – number of individuals accepted for reproduction in analysed interval with both immigrants parents.

The age structure can be described by weight of different age categories from entire population [4]. The age structure is expressed in years.

## 2. RESULTS AND DISCUSSIONS

The results regarding reproductive isolation coefficient (RIC or CIR) are showed in table 1.

The age structure for Gidran horse from Tuluțești stud farm is presented in table 2 and in the figures 1 and 2.

Table 1

**The reproductive isolation coefficient values**

Specifications		No.	Immigrants (I)	Parents			R.I.C.
				AA	AI	II	
Reproductive nucleus (RN)	♂	4	-	4	-	-	+1,000
	♀	26	-	17	9	-	+0,308
	Total	30	-	21	9	-	+0,400
Parents of RN	♂	11	1	8	2	1	+0,455
	♀	25	1	15	9	1	+0,200
	Total	36	2	23	11	2	+0,278
Grandparents of RN	♂	19	5	12	2	5	+0,263
	♀	32	3	29	-	3	+0,897
	Total	51	8	41	2	8	+0,608

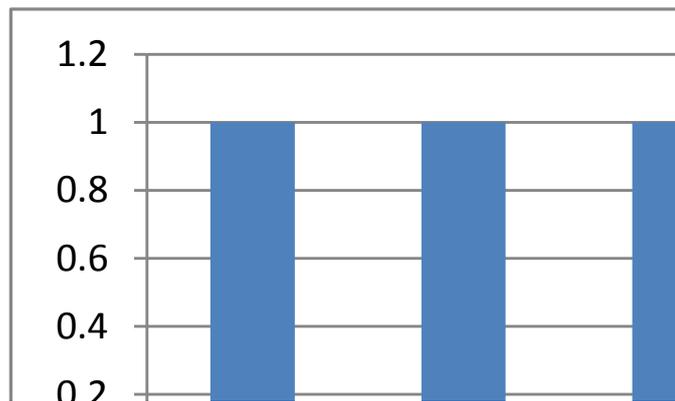


Figure no. 1. Sire stallion age structure

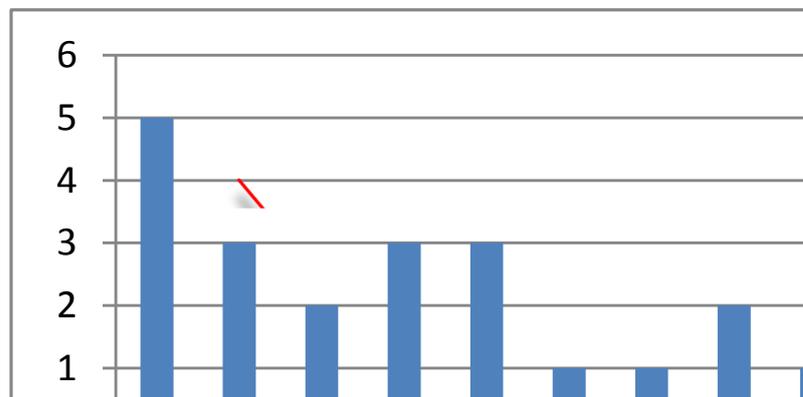


Figure no. 2. Brood mares age structure

The dates presented in table 1 relieve the fact that the Gidran Horse from Tulucești stud farm is still a true population with his own evolution and perfect distinct from other similar communities.

We can note that the reproductive isolation coefficient values are positive, but unconstant in generations successions, because of crossbreeding with other breeds (especially Throughbreed and Pure Arabian). Also, analyzing the data regarding current reproductive nucleus, and those of the last ranking papers (2010), we remark a nonlaudable tendency for decreasing the brood mares number and also ( $N = 73$ ).

From dates presented in table 2 and from figures no. 1 and 2, we observe an unbalanced age structure for Gidran horse from Tulucești stud farm. Regarding the mares, thanks to admittance in reproductive nucleus to a significant number of young mares (born in 2000-2005), the age structure, for this sex can be balanced in time if the strategy will be maintained.



### 3. CONCLUSIONS

1. The Gidran horse from Tulucești stud farm is still a population with his own evolution.
2. The value of reproductive isolation coefficient, are unconstant in generations successions because of crossbreeding.
3. The age structure is improper for increasing genetic progress because is increasing the generation interval as following the existence of a significant share of old parents (in specially in the sire stallions rank).
4. The reproductive nucleus is too small to allow a good management of inbreeding. The sire stallions are too old and it seems that is not any wish to change this situation (in stud farm they don't have offsprings to be candidates for reproduction).
5. The average age, for Gidran horse from Tulucești stud farm, have very different values between sexes: 18 years for sire stallions and 10,54 years for mares, and this fact make as the generation interval, estimated through this parameter, (considering an average value of 0,92 years for gestation in horses), at the populational level, to be bigger on the males way because of absence of holding males offsprings from fathers.

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## RESULTS AND PERSPECTIVES IN IMPROVING AND USING BREEDS OF SWINE IN THE REPUBLIC OF MOLDOVA

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**Key words:** breeds, prolificacy, precocity, fattening, reproduction, swine, increase.

### SUMMARY

This paper presents materials that concern the improving results of swine populations from Yorkshire, Landrace, Duroc, Hampshire and Pietrain breeds in the center of selection and hybridization, which were formed by imported swine herds in the Republic of Moldova, starting with 2003. It was ascertained that productive performance meets the standard breeds, but the work selection must continue to improve morpho-productive performances and create new genotypes, necessary in the process of hybridization of swines.

### 1. MATERIAL AND METHOD

The study of the productive capacities of Yorkshire, Landrace, Hampshire, Duroc and Pietrain breeds was fulfilled in I.S Moldusuinhibrid. It was appreciated the reproductive capacity of breeds using the following indices: prolificacy, weight of a pig or piglet lot at birth, number of piglets, weight of a piglet at weaning.

The capacity of weight gain was appreciated by the reaching age weigh of 100 kg, average daily gain, specific consumption and the thickness of bacon, determined with ultrasound device, combining ability of different lines and families, there were studied the Yorkshire and Landrace breeds, and parental combinations for Yorkshire and Duroc.

The performances of young pigs were appreciated by the trunk length, average daily gain and thickness of bacon determined on living body.

### 2. RESULTS AND DISCUSSIONS

The main way to increase production of pigs is the genetic amelioration by improving environmental conditions. The objectives of pig production consist in obtaining a greater number of annually products, from a sow, characterized by a growing speed, low feed per kg gain and carcass quality requirements that ensure consumer needs.

*Table 1*

**The reproductive capacities of swine breed ( $\bar{X} \pm S\bar{x}$ )**

Breeds	N	Prolificacy, cap	Weight of piglet lot at birth, kg	Weigh of a piglet at birth, kg	At weaning	
					Number of piglets	Weight of a piglet, kg
Yorkshire	15	10,2±0,10	12,75±0,85	1,25±0,01	9,5±0,15	10,2±0,33
Landrace	14	10,8±0,25	14,14±0,62	1,31±0,02	9,8±0,12	10,6±0,28
Hampshire	8	9,5±0,18	11,41±0,49	1,20±0,04	9,0±0,31	10,4±0,35
Duroc	7	8,9±0,12	12,90±0,62	1,45±0,06	8,6±0,42	11,5±0,36
Pietrain	6	8,5±0,20	11,05±0,39	1,34±0,05	8,0±0,26	10,9±0,41

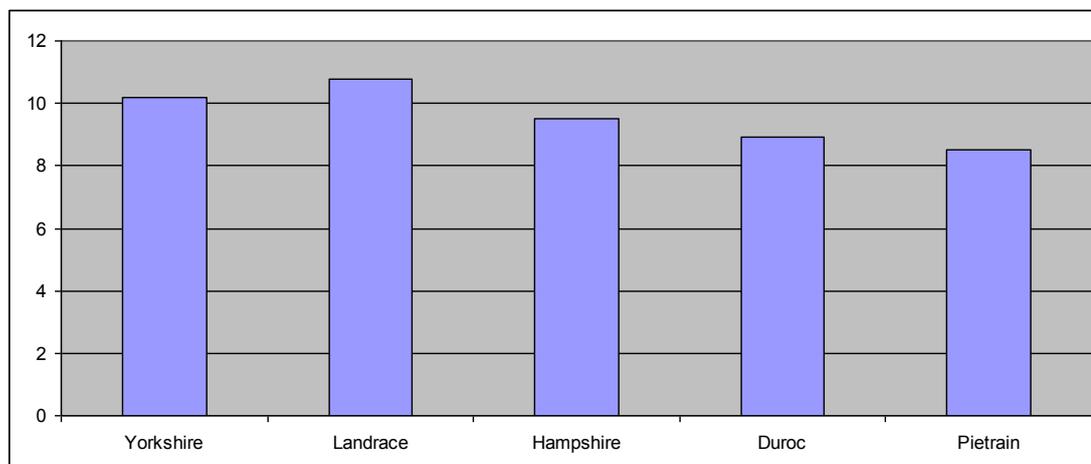


Figure 1 Prolificacy, heads

Results presented in the table show that prolificacy of sow varies with breed. Native breeds were characterized by major reproductive capacities, prolificacy being with 1,3-2,3 piglets ( $B > 0,999$ ) larger in comparison with paternal breeds. Weight of piglet lot at birth was bigger at Landrace breed (14,14), followed by Duroc (12,90) and Yorkshire (12,75). The differences between the breeds and Hampshire and Pietrain were equal with 1,43-3,09 kg, authentic being only the bigger difference ( $B > 0,999$ ).

Piglets at birth were characterized by a good development, but the medium weight varies from a breed to another. An intensive growth was reported at Duroc race (1,45), then at Pietrain (1,34) body mass was higher at Duroc breed, with 0,25 kg ( $B > 0,999$ ), in comparison with Hampshire breed and 0,20 with Yorkshire ( $B > 0,999$ ). This tendency was kept at weaning, when the difference regarding the weigh of a piglet was equal with 1,1 and 1,3 ( $B 0,90$ ). Piglets at weaning were kept in a larger number at paternal breeds in comparison with maternal ones, Yorkshire and Landrace, where the value of index was 0,7-1,0 piglets ( $B > 0,99$ ).

Piglet growth was manifested differently in the fattening period, having a direct influence on attaining the age of 100 kg weight and on the specific consumption. Better results showed the young swine of Duroc breed, which was characterized by a bigger growing speed and a smaller amount of forage consumed to form a kg increase. (tab 2)

Table 2

Capacity of fattening pigs of different breeds

Breed	N	Reaching age weight of 100 kg, days	Average daily gain, g	Specific consumption, kg forage	Bacon thickness, mm
Yorkshire	20	188±2,21	531±32,4	4,01±0,28	20,0±2,27
Landrace	16	200±3,61	500±37,3	4,12±0,20	19,0±1,14
Duroc	16	180±4,42	620±40,2	3,83±0,44	21,9±1,96
Hampshire	18	192±3,14	560±44,1	3,98±0,23	18,2±2,33
Pietrain	20	227±4,25	518±27,5	4,31±0,25	17,5±2,10

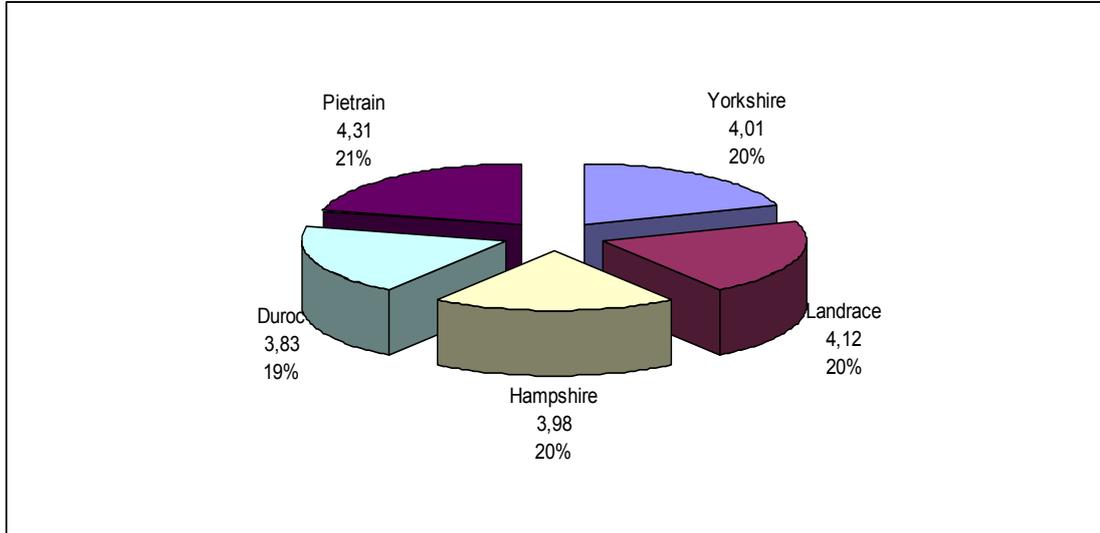


Figure 2 Specific consumption, kg, fodder

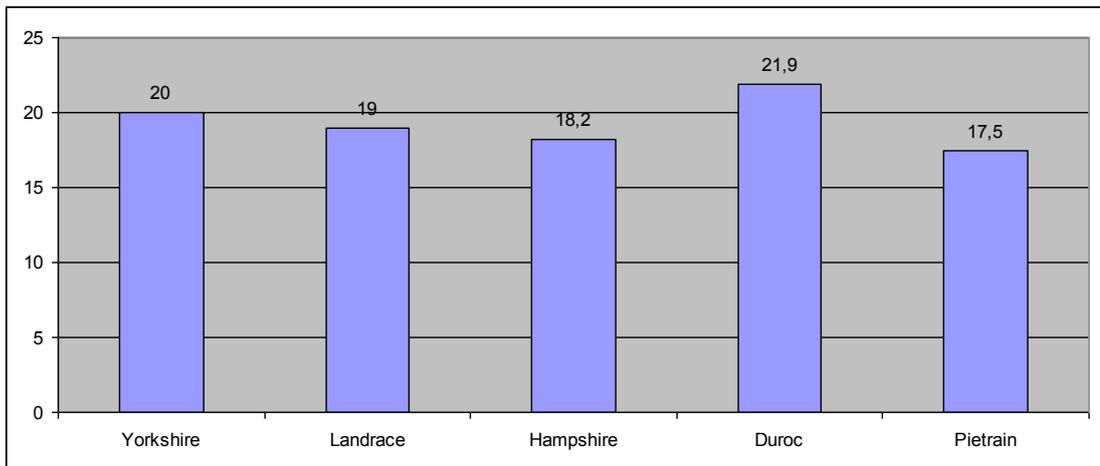


Figure 3 Thickness layer of bacon, mm

The dates presented in table 2 show that at swine of different breeds the capacity to gain weight varies. 100 kg weight of young pigs from Duroc breed was reached at 180 days, while Pietrain breed in 227 days, the difference being significantly equal with 47 days ( $P < 0,0001$ ). This dates prove a reduced prolificacy of young pigs from this breed than with Duroc, Yorkshire and Hampshire breeds.

Assertion is confirmed by the fact that for Duroc breed is characteristic a higher daily gain, differences comparatively with Pietrain, Hampshire, Yorkshire and Landrace races being within 90-120 days ( $P < 0,05$ ). In the fattening period, an average daily gain

obtained from Duroc piglets was 620 g, while those from Landrace and Pietrain breed were 500-518 g.

Data for specific consumption, reveal that Duroc swine consumed to form a kg increase, 3.83 kg of combined forage, this result being more reduced than piglets from Pietrain breed with 0.44 kg, but the differences are insignificant, because we can notice a downward trend of specific consumption. A lower layer of bacon was found at young pigs of Pietrain breed, which was equal with 17,5 mm, being less with 4.4 mm, comparatively with Duroc breed.

Table 3

**Combinative capabilities of lines and families of maternal breeds**

Combinations of lines and families	Productivity		Fattening qualities of descendants		
	Prolificacy, heads	Weight of a piglet at birth	Reaching age 100 kg, days	Fodder costs, kg, fodder/ kg gain	Thickness layer of bacon, mm
1	2	3	4	5	6
Yorkshire					
Icar x Idea	8,7	1,6	189	3,7	17
Icar x Inda	11,5	1,5	189	3,4	21
Icar x Iota	9,3	1,6	188	3,6	18
Icar x Ița	10,0	1,4	189	3,5	19
Icar x Iea	11,8	1,5	187	3,5	21
Idol x Ida	11,5	1,4	203	3,2	16
Idol x Iota	11,0	1,7	208	3,3	19
Inel x Ida	10,6	1,5	187	3,4	21
Inel x Ideia	11,0	1,4	187	3,4	21
1	2	3	4	5	6
Inel x Iea	8,5	1,8	187	3,4	21
Inel x Inda	10,5	1,5	187	3,4	21
Inel x Ița	11,0	1,4	187	3,4	21
Landrace					
Laur x Lama	10,0	1,6	189	3,3	20
Lin x Lama	10,2	1,6	187	3,4	21
Lin x Lira	10,2	1,6	187	3,4	21
Lin x Luna	10,1	1,5	186	3,6	20
Lux x Lira	15,0	1,2	187	3,4	21

Results presented in the table confirm that sow prolificacy from this combinations is good and corresponds with usual standards, but not for all combinations is characteristic such a tendency. Line Icar in combination with Idea and Lota proved a prolificacy that was framed within the limits of 8,7 and 9,3 piglets, and Inel line, in combination with Iea family – 8,5 piglets. In the following generations such combinations must not be repeated.

Table 4

**Fattening capacity and carcass quality of pigs from the best parental combinations**

Parental combinations		n	Average daily gain,g	Specific consumption(kg fodder/kg increase)	Trunk length, cm	Thickness layer of bacon, mm
Name and number of boar	Name and number of sow					
Yorkshire						
Ideal 105	Inda 292	4	578±53,6	4,13±0,44	126,0±3,81	23,4±2,1
	Iera 6	4	662±80,6	2,71±0,23	128,7±5,25	16,5±2,27
	Ideia 68	4	644±27,7	3,18±0,03	128,5±2,61	17,2±1,12
Duroc						
Dog 1	Dama 44	4	560±44,0	3,98±0,20	127,5±5,41	21,9±1,91
	Dama232	4	680±37,5	3,30±0,28	126,6±6,14	20,3±2,7
	Dama100	4	644±40,3	3,48±0,25	120,3±5,40	20,8±1,92

Dates in the table reveal that productive descendants performances vary in function of genetic potential parental shapes. A lower specific consumption (2.71), also a lower layer of bacon (16,5), was recorded at descendants obtained from combination of Ideal boar 105 and Iera sow 6 (  $B>_{0,999}$ ). The difference from this combination and Ideal 105 x Inda 252 concerning this indicators was 1,42 kg (  $B>_{0,99}$ ) and 6,9 mm (  $B>_{0,99}$ ). Differences in Duroc breed by the average daily gain between combinations Dog 7 x Dama 232 and Dama 44 were equal with 80 g and by the specific consumption 0.58 kg.

Value layer of bacon in all combinations was in the limits from 20.3 and 21.9 mm, but significant differences were not signaled. We can notice only some tendencies to decrease bacon layer at some parental combinations.

### 3. CONCLUSIONS

1. Prolificacy of maternal Yorkshire and Landrace breeds was higher with 1.3-2.3 piglets comparatively with paternal ones, Duroc, Hampshire and Pietrain. An intensive growth during embryonic period has been reported at Duroc piglets, in this way, a piglet birth weight being equal with 1.45 kg.
2. The fattening capacity at swine of different breeds varies, Duroc piglets have reached 100 kg weight in 188 days while Pietrain ones in 227 days, the difference being of 47 days (  $B>_{0,999}$ ). Average daily gain at Duroc swine was with 90-120 g more advanced and specific consumption with 0.15-0.48 kg lower than Pietrain, Hampshire, Yorkshire and Landrace breeds. Bacon thickness was thicker at Pietrain breed, differences being till 4.4 mm.
3. Combining ability of lines and families is good and meets the standard, but not for all combinations being characteristic such tendency. Icar line in combination with

Idea and Iota families has proven a prolificacy between 8.7 and 9.3 piglets, and Inel and Iea lines- 8.5, the results indicate that following generations must not repeat such combinations.

4. To obtain and advanced piglet production it is rational to use Yorkshire and Landrace breed, as maternal constitute, which is characterized by good reproduction capacities, and Pietrain, Hampshire and Duroc as paternal constitute to obtain and capitalize hybrids in production.

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## POSSIBILITIES OF EARLY PREGNANCY DIAGNOSIS USING BLOOD SERUM PROGESTERONE TEST IN KİLİS COWS

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Key words: Kilis cow, early pregnancy diagnosis, blood progesterone.

### SUMMARY

In the research it was aimed to investigate possibilities of using of blood serum progesterone test in early pregnancy diagnosis in Kilis cows. The material of the study was formed by blood samples collected from 20 Kilis cows which were belong to 17 farmers of Aydınbahçe Village of Yayladağ District of Hatay Province, on the 40<sup>th</sup> day of artificial insemination.

Progesteron analysed in the serum of blood samples. Pregnancy was estimated by progesteron concentration in the samples. Pregnancy was confirmed on the 90<sup>th</sup> days after insemination by rectal palpation of the uterine contents.

Progesterone levels of pregnant and non-pregnant cows on the day 40<sup>th</sup> of insemination were calculated as  $2.910 \pm 0.6709$  ng/ml, and  $0.65 \pm 0.740$  ng/ml respectively.

It was concluded that it is possible to determine of pregnant and non pregnant ones at accuracy 81.25 % and 100% respectively according to blood progesteron levels at the 40<sup>th</sup> day of insemination.

Reproductive efficiency is effected from calving interval directly in dairy cows. Shorten of time between calving and concept helps shorten of calving interval (Esselmont, 1992). Whereas, after 90 days from insemination it is possible to diagnosis of pregnancy by palpation from rectum.

There are progesterone in various levels in blood during reproductive cycle and pregnancy. Progesterone level is low during heat ( $< 1$  nmol/l). As corpus luteum grow up after ovulation the level begin to increase. If cow do not inseminate or pregnancy do not realize, degeneration starts in corpus luteum because of prostaglandine which secretes from uterus in 17th days of the cycle approximately.

As the cow return to heat, progesteron level decreases to minimum concentration in 21-24 days after insemination ( $< 1$  nmol/l). But, if the cow is inseminated and concepted corpus luteum continues its presence and the cow don't show heat again. Progesterone concentration stays high along the gestation ( $> 3.5$  nmol/l) (Kamboj and Prakash, 1993).

If the cow do not pregnant and have regular oestrus cycle, progesterone level in milk follows one cyclic pattern that decreases beginning 2 days before until 4-5 days after of heat and increases in the middle of cycle [(Sherarer, 2003)].

In dairy cows, it is informed that blood progesterone level is smallest (0.21 ng/ml) in heat, increases (1..5 ng/ml) in 7th day and highest (2.21 ng/ml) in 14th day and later decreases (0.38 ng/ml) in 21th day. Progesterone level stays highest (2.69 ng/ml) at 21th day in the cows concepted. If the progesterone level is lower than 1 ng/ml at insemination

day, and higher than 2ng/ml at 21th day, likely the cow is pregnant. The cow is not pregnant if progesterone level is <1 ng/ml at 21th day (Anonym, 2004).

The changes of progesterone concentrations of blood and milk were measured from 10th day until 40th day of insemination in Murrah buffaloes. Researchers reported that progesterone concentration in blood plasma (0.1ng/ml) increased until 3.6 ng/ml at 13th day. In the cows concepted increasing also continued after 13th day. In the cows that did not concept 3 days before from next heat concentration decreased to 0.6 ng/ml (Batra et al, 1979).

Progesterone test gives correct conclusion (95-100%) in determine that the cow do not pregnant. If the progesterone level is low, the cow can't be pregnant. Because if the cow have very low progesterone level the (0.1 ng/ml), can not keep alive fetus longer than a few days following ovulation . Although, high progesterone concentration ( $\geq 1.5$  ng/ml) is correct only 85-88% in estimation that the cow is pregnant (Larry, 1986). High progesterone level can be some following reasons; some ovary diseases, abortion after taking sample, shorter or longer than normal heat cycle, taking sample in error time. The maximum mistake resource is not taking sample in correct time (Collins, 2002).

Drake and O'connor (Drake and O'connor, 2001) had taken blood samples at insemination day and after 20 days from insemination in order to analyse progesterone level. Researchers reported that the Project can provide possibility in embryonic mortality (death after 42 days from conception) rate in bovine. Embryonic mortality is accepted according to following situations; Low progesteron level at insemination day, high concentration at 20th day after insemination, determination by rectal palpation that the cow do not pregnant at 40th day after insemination. By using thus criteria in the research 24% of conceptions determined in the population are resulted by embryonic death.

Toolse (Toolsee, 2003) reports that accuracy of pregnant and non pregnant cows rate are 97.5% and 83% respectively by using milk progesterone test. Researcher inform that accuracy of pregnancy by milk progesterone test can be effected by following factors; time between 2 heats are different from cow to cow, presence of permanent corpus luteum , application of insemination during luteal phase, embriyonic deaths. Non pregnant cow can have heat earlier 21 days after insemination. Like this cow can ovulate an done corpus luteum can form. This is because progesterone level can increase at 22-24 days. So this cow can be diagnosed as pregnant as mistake. The cows have reproductive problems (ovary cyst or uterus infections) also have high progesterone level ( $>3.5$  nmol/l), then can be diagnosed as pregnant. Sometimes cow can be inseminated at false heat ( $>1.5$  ve  $<3.5$  nmol/l) . After 21 days from insemination this cows even if do not pregnant, in generally in luteal phase and have high pregesterone level ( $>3.5$  nmol/l) (Gordon, 1996).

In the research it was aimed to investigate possibilities of using of blood serum progesterone test in early pregnancy diagnosis in Kilis cows.

## 1. MATERIAL AND METHODS

In the research it was aimed to investigate possibilities of using of blood serum progesterone test in early pregnancy diagnosis in Kilis cows.

The material of the study was formed by blood samples collected from 20 Kilis type of South Yellow Red cows which were belong to 17 farmers of Aydınbahçe Village of Yayladağ District of Hatay Province, on the 40<sup>th</sup> day of artificial insemination.

Buffalo cows were subjected to clinical examination in point of reproductive problem and pregnancy on 31.08.2006. On the same days 23 multiparous buffalo cows, which had not pregnant and had not any reproductive problem, had received an intravaginal drug release device (PRID) intravaginally. PRID were kept for 12 days in uterine. On the 12<sup>th</sup> day after PRID insertion, 2 ml prostaglandin (PGF<sub>2</sub>alpha)(estrumate) an injection had applied and next day PRID had been taken out. After 2.5 days (approximately 56 hours) 2 ml GnRH (dalmarelin) was injected and insemination was applied artificially.

After 40 days from insemination blood samples were taken from 21 (x) inseminated cows. In order to get serum, centrifugation was applied on blood samples taken immediately Serum samples belong to each cows were labelled and placed in deepfreeze (-20 C<sup>0</sup>). Progesterone analyses were done in Konya Selçuk University, Veterinarian Faculty, Bio Chemistry Department by using Double Antibody Enzyme Immunoassay (EIA) Method (Van de Wiel and Koops, 1986). Pregnancy was estimated by progesteron concentration in the samples. Pregnancy was confirmed on the 90<sup>th</sup> days after insemination by rectal palpation of the uterine contents.

## 2. RESULTS AND DISCUSSIONS

Progesteron levels in blood samples at 40th day of insemination and the cows which diagnosed as pregnant by palpation of uterine content at 90th day of insemination are shown in Table 1

By inspecting Table 1 can be interpreted following;  
According to results of palpation at 90th day of insemination 14 cows conceived. This means that, 63.6% of inseminated cows conceived.

According to blood progesterone concentrations results of 21 cows at 40th day of insemination( $\geq 1$  ng), it was estimated that 16 cows conceived. But, in 90th day it was understood that 3 of them do not pregnant. These cows likely conceived, but in 40-90 day period had abortion. Or, the cows that have reproductive problems (ovary cyst, uterine infection, etc) because of at 40th day could be showed high progesterone level and diagnosed as pregnant (Gordon, 1996). As a result of accuracy of pregnancy diagnosis based blood progesterone level at 40th day of insemination is 81.25%. This result resemble to literature knowledge given (Larry, 1986; Toolsee, 2003).

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(x) One of the inseminated cow had sold after insemination, blood sample could not be taken from one other cow.

Table 1

**Progesteron levels in blood samples at 40th day of insemination and the cows which diagnosed as pregnant by palpation of uterine content at 90th day of insemination**

Farmer	Sample No	Progesteron ng/ml (at 40th day)	Evaluation of pregnancy	
			According to progesteron level (at 40th day of insemination)	According to palpation (at 90th day of ins.)
Mehmet Tunç	1	4.37	+	Pregnant
Ahmet Yılmaz	2	1.98	+	-
Hanifi Kılıç	3	0.10	-	-
“	4	Trace	-	-
Mehmet Kılıç (şakir)	5	3.10	+	Pregnant
Mehmet Kılıç“	6	0.78	-	-
“	7	1.28	+	-
Mehmet Kaçar	8	2.00	+	Pregnant
Rıza Aslan	9	2.84	+	Pregnant
Yakup Şahin	10	2.29	+	Pregnant
Mevlüt Şahin	11	2.67	+	Pregnant
Abdullah Avaz	12	2.61	+	Pregnant
Mustafa Kılın	13	2.78	+	Pregnant
Hayrettin Kılınç	14	2.90	+	Pregnant
Mehmet Çatlak	15	Trace Amount	-	-
Galip Yapıcı	16	Trace Amount	-	-
“	17	3.44	+	Pregnant
Cemel Yapıcı	18	1.06	+	-
Mehmet Yapıcı	19	2.95	+	Pregnant
“	20	2.06	+	Pregnant
Beşir Kaçar	21	3.83	+	Pregnant
Muzaffer Kaçar	Sold		?	Sold
Rıza Yılmaz	No sample	?	?	Pregnant

In this research, accuracy of diagnosis estimation of non pregnant based blood progesterone level at 40th day of insemination is 100%. It can be said that also this result also resemble to literature knowledge given (Larry, 1986; Toolsee, 20038, 10).

Progesterone levels of pregnant and non-pregnant cows on the day 40<sup>th</sup> of insemination were calculated as  $2.910 \pm 0.6709$  ng/ml, and  $0.65 \pm 0.740$  ng/ml respectively. The averages belong to pregnant and non pregnant are harmonious with literature knowledge (Batra et al, 1979; Kamboj and Prakash, 1993; Anonym, 2004).

It was concluded that it is possible to determine of pregnant and non pregnant ones at accuracy 81.25 % and 100% respectively according to blood progesterone levels at the 40<sup>th</sup> day of insemination

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## THE INFLUENCE OF SEASON AND AGE IN THE HEMATOLOGIC PARAMETERS OF SHEEP

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**Key words:** sheep, blood, hematologic parameter, season

### SUMMARY

The aim of this study was hematologic monitoring in sheep. It was carried out during four seasons to define the normal hematologic values and variations, to create a table for the value of norms and to pinpoint the factors that influence these values. The study included the definition of the C.B.C indices. A total number of 56 samples were examined during one year. The results were conditioned by the kind of breeding, the gastrointestinal parasites, age and sex. The number of erythrocytes varied from 3.8 up to 10.4 million per mm<sup>3</sup> blood, where the maximal figure was noticed in the three – month- old lambs. The biggest variations were related to the indices of the leukocyte formula and these were more evident compared to age and sex. The seasonal influence was present for hematocrit, hemoglobin, erythrocyte, eosinophils and monocytes. An increase in the number of leukocytes was noticed during the period of autumn-winter, as well as in the percentage of neutrophils and eosinophils within the erythrocyte formula. Leukocytosis, eosinophilia and the low number of erythrocytes are explained by the existence of parasitosis, allergic states, bad nutrition, acute and chronic processes in the respiratory apparatus related to the season.

The sheep which were used to carry out the experiment do not represent all the variations of sheep in our country. There are only a few pure breeds, most of which are crossbred and the breed of the country generally dominates. Monitoring held in different seasons of the year aims to determine normal hematologic values, seasonal variations and the creation of a table for the value of norms, thus considering it as a modest help for all those who will deal with aspects of applied hematology and hematologic diagnosis in sheep in the future. The conditions of sheep breeding where the study was carried out (E.D.E = Experimental Didactic Economy) are not the same as the comparative values that we refer to for the normal hematologic indices. Food treatment in sheep presents a lot of variations, which will necessarily influence the indices of the blood table. (Steven, et al. 2004).

CBC (complete blood count) includes a range of indices, among which we mention: the counting of white blood cells WBC (white blood count), the differential count of white cells (leukocyte formulae), the count of red cells RBC (red blood count), hematocrit (HCT) and the packed volume of blood (PCV), the count of thrombocytes and the thrombocyte indices, hemoglobin (Hg b), its values and pathological forms, the erythrocyte indices MCV, MCH, MCHC, the differences between cellular elements in form, colour, size, inclusions etc. (Van Houten, et al., 1992) as well as the examinations for the factors of blood coagulation, ph of blood and examinations about gases of blood, proteins, fractions, vitamins, hormones etc. (Van Houten, et al., 1992).

Through this study we aim to highlight the differences of the indices in the table of blood in sheep depending on age, season, type of breeding etc.

### 1. MATERIAL AND METHOD

The study included the determination of the C.B.C indices (erythrocytes, leukocytes, thrombocytes, hemoglobin, erythrocyte indices, cellular changes). Accurate protocols accompanied each sample. During the study venous blood was sampled in the jugular vein. The blood was taken by means of EDTA and citrate of Na and K. The count of erythrocytes and leukocytes was carried out manually with Burcher camera. Hemoglobin was defined according to the technique of hemacytometer. Hematocrit was determined by means of the classical method with capillary tubes, after Alexander & Griffiths, 1993. The leukocyte formula and cellular differences were noticed in the blood sample examined by the microscope with immersion. (Bernard et al., 1994). The blood sample underwent morphocitometric comparisons and evaluations. To evidence the influence of the factor age the data were grouped under three categories; sheep and rams above 2 years old, sheep and rams from 1 up to 2 years old and lambs up to 1 year old. To evidence the influence of the factor sex the animals were divided into sheep, one-year-old sheep and rams. To evidence the differences depending on categories and seasonal variations in each season we examined 8 sheep, 2 rams, 2 one-year-old sheep and 2 lambs. The animals were selected clinically healthy, and their individuality together with the data in the four seasons of hematologic examinations were kept safe. The pathological and clinical differences were marked for each case and they coincided with the special individuals in the examination moment. 56 samples were examined altogether during one year. The examinations were carried out in the Veterinary Laboratory of Clinical Diagnosis in the Faculty of Veterinary Medicine in Tirana.

### 2. RESULTS AND DISCUSSIONS

The following table shows hematologic examinations grouped according to indices, categories and seasons. In the following tables we present minimal and maximal values and their average. In the category of rams, one-year-old sheep and lamb the average is the value for two head and the indices consider the fact that for each group of these categories only two head were examined.

Table 1

**The hematologic indices of sheep in spring**

Indices	Sheep	Rams	One-year-old sheep	Lambs
	Values Min-max Average	Values Min-max Average	Values Min-max Average	Values Min-max Average
Erythrocytes in million	4,8-7,6 5,2	4,9-6,7 5,6	4,8-6,4 5,6	6,6—6,8 6,7
Leukocytes in 1000	5,6-6,8 6,2	6,1-6,4 6,25	5,4-6,8 6,1	5,8-7,8 6,8
H c t	30-38 35	30-36 33	34-37 35,5	32-36 33

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H g b	8,06-10,2 8,6	9,2-9,6 9,4	9,2-10,4 9,8	7,8-10,4 9,1
Lymphocyte %	46-54 50	58-64 61	50-62 56	52-66 59
Neutrophils %	13-59 44	28-46 37	40-66 53	34-42 38
Eosinophils %	0-8 3	0-4 2	0-6 3	0-0 0
Monocytes %	0-4 2	0-3 1,5	0-4 2	0-4 2
Basophils %	0-1 0,2	0-1 0,5	0-5 2,5	0-1 0,5

Table 2

**The hematologic indices of sheep in summer**

Indices	Sheep	Rams	One-year-old sheep	Lambs
	<i>Values Min-max Average</i>	<i>Values Min-max Average</i>	<i>Values Min-max Average</i>	<i>Values Min-max Average.</i>
Erythrocytes in million	4,2-7,2 4,85	4,6-7,8 6,2	4,2-6,8 5,5	7,8-10,4 9,2
Leukocytes in 1000	5,05-9,6 6,8	5,6-7,2 6,4	6,4-7,2 6,8	8,2-9,6 8,9
H c t	28-34 30	34-36 35	30-36 33	35-42 38,5
H g b	8,8-10,4 9,6	9,6-10,0 9,8	8,4-10,5 9,45	8,2-9,4 8,8
Lymphocyte %	50-54 52	56-62 59	54-58 56	52-62 57
Neutrophils %	32-48 40	28-36 32	42-60 51	30-68 49
Eosinophils %	0-8 3	4-6 4	0-6 3	0-5 2,5
Monocytes %	0-5 2,5	0-6 3	0-4 2	0-3 1,5
Basophils %	0-1 0,2	0-1 0,5	0-5 2,5	0-6 3

Table 3

**The hematologic indices of sheep in autumn**

Indices	Sheep	Rams	One-year-old sheep	Lambs
	<i>Values Min-max Average</i>	<i>Values Min-max Average</i>	<i>Values Min-max Average</i>	<i>Values Min-max Average</i>
Erythrocytes in million	3,9-6,8 4,7	4,4-6,4 5,4	4,2-6,2 5,2	6,4-7,6 7,0
Leukocytes in 1000	5,2-8,0 6,6	6,0-7,2 6,8	6,5-6,8 6,65	6,3-6,8 6,55
H c t	34-38 35	36-36 37	34-38 36	34-39 36,5
H g b	8,5-9,2 8,85	8,2-8,6 8,4	8,6-9,2 8,9	7,8-8,6 8,2
Lymphocyte %	44-52 45	50-52 51	42-56 48	44-50 47
Neutrophils %	26-52 46	38-42 35	36-52 44	38-46 37
Eosinophils %	0-8 3	0-4 2	0-8 4	0-6 3
Monocytes %	0-6 3	0-3 1,5	0-4 2	0-2 1
Basophils %	0-1 0,2	0-1 0,5	0-5 2,5	0-6 3

Table 4

**The hematologic indices of sheep in winter**

Indices	Sheep	Rams	One-year-old sheep	Lambs
	<i>Values Min-max Average</i>	<i>Values Min-max Average</i>	<i>Values Min-max Average</i>	<i>Values Min-max Average.</i>
Erythrocytes in million	3,8-6,0 4,9	4,0-5,6 4,8	4,2-6,2 5,1	4,0-4,8 4,4
Leukocytes in 1000	6,8-9,6 7,2	6,6-8,2 7,3	6,0-7,2 6,6	5,2-7,6 6,4
H c t	26-32 28	32-34 33	30-32 31	30-38 34

H g b	8,4-8,8 8,6	7,6-9,0 8,3	8,0-9,0 8,45	7,8-8,4 8,2
Lymphocyte %	40-54 56	46-60 53	50-56 53	42-52 47
Neutrophils %	38-48 43	36-40 38	46-50 48	36-52 44
Eosinophils %	4-8 6	4-6 5	2-6 4	3-5 4
Monocytes %	1-5 3	1-2 1,5	1-4 2,5	0-0 0
Basophils %	1-8 4,5	1-6 3,5	3-5 4	2-6 4

It is obvious that a range of hematologic indices are lower than the ones of the authors we referred to, and this is more evident for the erythrocytes, hematocrit and hemoglobin, while the values that are related to the quantitative indices and the differential values of the leukocytes present analogy with the authors.

The values of the hematologic indices in sheep present little analogy with the quantitative indices, while on the other hand they resemble a lot with the values that refer to the size of erythrocytes. Depending on the type of breeding and the gastrointestinal parasites, which are more present than in adult ruminants, differences to the indices of the blood table are noticed. (Steven, et al., 2004). However the data that we evidenced in the practical clinic, excluding any certain extreme case, do not present an essential influence in the hematologic indices.

The studies show that the sheep might have normal hematologic and clinical table, but are not necessarily free from the gastrointestinal parasites. The variations in the value of hemoglobin do not show strong influences of the season in the observed values, while the influence of age is evident in these values. Younger animals in all the seasons have higher values than adult animals. The lowest value of haemoglobin appears in spring. The low values of haemoglobin indices might be related to the breed and the influence in value of the breeding indices. (Soch, et al., 2010).

The highest influence in hematologic indices is related to the age of the animals. (Alsalam, et al., 1999). This is obvious when in lambs, during their first three months of life, we counted up to 10.4 million erythrocytes per mm<sup>3</sup>. Hematocrit varies in the same variations as erythrocytes and this is completely explainable when we know that in laboratory observations the package of erythrocytes is equal to hematocrit.

From the data presented in the results table it is noticed that with the increase of age there is a tendency to reduce and stabilize the number of cellular elements, such as erythrocytes as well as leukocytes. Considering the tables it results that in younger animals the number of erythrocytes, hematocrit, erythrocyte package and leukocyte is higher than in the categories of one-year-old sheep, sheep and rams.

This physiological occurrence is explained with a high intensity of the hemopoetic system, which coincides with the period of growth and maturation of

animals. From the indices taken in the study for all the categories, we notice that although erythrocytes belong to average limits, leukocytes are in normal limits of the average norm confronted to the data of the literature.

From this comparison it results that the number of erythrocytes even though a little under average, does not bring considerable changes with the data of the confronted materials. We think that the changes are an attribute to breed, its combinations and the influence that the breeding conditions of the E.D.E sheep have on animals, which must be stressed are not optimal ones. Thus for example the number of erythrocytes in our study varies from 3.8 to 10.4 million while Schalm gives limits from 6-8 million per mm<sup>3</sup> blood. Nearer to our data are the erythrocyte values given by Bernard with 4-7 million per mm<sup>3</sup> blood. Whereas leukocytes compared to the same authors mark normal limits and we may say that the variations are low among the age groups while the authors refer values, such as: Foster 4-13 thousand, Uthman 3.1- 11.88, etc. Depending on the season for all the categories the indices of the quantitative evaluations related to leukocytes, remain within the norm with a slight tendency to increase the values during winter. (Weber, et al., 2007).

From the indices taken in our study, the level of eosinophils appears to be interesting, compared to the data of the material with which we confronted our work. It shows an increase in the value of real numbers and percentages which was more evident during the season of spring and autumn. Perhaps the conditions related to the parasitic diseases and allergic states (SLE) are the natural cause of these variations. From clinical examinations, especially to sheep and rams, rhinitis were evident indices during these periods.

The consulted authors offer figures from 0-6% eosinophils, while our data only in a few cases go beyond these values. They are between the values of 0 up to 8 %. We must point out that based on the categories of animals variations in values of the eosinophils are not considerably evident in the sheep. From the conclusions of the examination results we notice that the changes among categories related to the quantitative hematologic indices are more evident in adult animals (age), while the changes in eosinophils are more evident in intermediate ages. The hematologic values especially the quantitative indices vary slightly from the values given by the authors we confronted in our study. We think that these changes are closely related to the breeding characteristics and growth of the E.D.E sheep, variability of race and nutrition, their season, age, breed etc. The changes based on the factor age, sex and the indices of the leukocyte formula are evident. While the number of leukocytes reduces during growth, the contrary happens with the number of eosinophils and this is at least attributed to the gastrointestinal parasites, which are typical in sheep in proportion to their age.

The study examined the quantitative indices in the four seasons in each individual and the variations were really low to come to the conclusion based on these changes. This was an unpredictable event considering the conditions of the EDE sheep and problems we ran into during the sampling moment, while the animals were being controlled clinically. This clearly evidenced that the variations in the number of leukocytes in sheep are lower compared to the group of pets.

The greatest variations had to do with the leukocyte formula indices which were more evident in proportion with sex, age and seasonal influence (hematocrit, hemoglobin, erythrocyte, eosinophils and monocytes, etc).

These variations are of a great interest to create specific groups in the future, for statistical data-processing with indices of cellular elements in blood, in order to overpass the stage of preliminary hematologic evaluations.

### 3. CONCLUSIONS

- The highest influence in the hematologic indices is related to the age of animals. This is obvious when in lamb of three months old we counted up to 10.4 million erythrocytes per mm<sup>3</sup>.

- It resulted that the number of erythrocytes, although a little bit under the average, did not cause considerable changes with the data of the confronted materials. The highest variations had to do with the indices of the leukocyte formula, which were more evident in proportion with sex, age where the seasonal influence ( hematocrit, hemoglobin, erythrocytes, eosinophils, monocytes etc).

- From the conclusion of the survey results, we notice that the changes among categories related to the quantitative hematologic indices are more evident in adult animals (age), while the indices of the leukocyte (eosinophils, monocytes) are more evident at intermediate ages.

- The examination results might be used as reference parameters for the analysis that will be carried out on sheep in the future for monitoring or diagnosing purposes.

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**BODY MORPHOMETRY OF THE SHORT BEAKED COMMON DOLPHIN  
(*Delphinus delphis*) ON THE EASTERN COAST OF THE TURKISH BLACK SEA**

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**Key words:** Black sea, common dolphin, morphometry

**SUMMARY**

The short beaked common dolphin (*Delphinus delphis* (Linnaeus, 1758)) is a species of common dolphin. It lives in the warm temperate portions of the Atlantic and Pacific Ocean. It is also found in the Caribbean, Mediterranean and the Black Sea. The aim of the study is to gather information about the body morphometry of the short beaked common dolphins which live on the eastern coasts of the Black Sea and then the obtained parameters are compared with the similarities or the differences between the other species of the dolphins which live on the other coasts of the Black Sea and the oceans. For the research, a total number of 119 short beaked common dolphin consisting of 52 female and 67 male, which are drowned by gill nets or stranded ashore in the eastern coast of The Black Sea, are investigated. The body morphometry of the animals are determined with the help of tape measure and callipers on the basis of twenty nine criterias in paralel with published literature data. For the all measurements, right side of the animals is used. As a result of these, the largest short beaked common dolphin on the eastern coast of the black sea is 190 cm and the smallest one is 103 cm. The average lenght of female dolphins are 158,86 cm and the average lenght of male dolphins are 160,09 cm. So the body lenght of the short beaked common dolphin on the eastern coast of the Black Sea is lower than the Eastern North Atlantic Ocean.

The common dolphins are one of the most widespread species of the Delphinidae. The common dolphins are typically ichthyophagus cetaceans, feeding chiefly on pelagic fish. They usually catch fish far from the shores (Tomilin, 1957). They are slender and have a long beak sharply demarcated from the melon. The dorsal fin is high and moderately curved backwards. They are distinguished from other species by a unique crisscross colour pattern formed by interaction of the dorsal overlay and cape (Perrin, 2009). In the Atlantic Ocean, the common dolphin ranges as far as Norway and Iceland, occurring in the Baltic sea, North sea, Mediterranean, and Black Seas, at the coasts of North America, Africa, and Tristan da Cunha I. In the Pacific, it has been observed at the shores of California, Japan, China, in the Sea of Okhotsk and Sea of Japan (Tomilin, 1957). The Black Sea has a very fragile ecosystem because it is semi-enclosed and has the largest anoxic water mass on the planet (Öztürk et al., 1999). It is a naturally isolated body of water in which 3 cetacean species are found; the common dolphin (*Delphinus delphis*), the bottlenose dolphin (*Turciops truncatus*) and the harbour porpoise (*Phocoena phocoena*) (Viaud-Martinez et al, 2007).

The purpose of the study was to define the body morphometry of the short beaked common dolphins which live on the eastern coasts of the Black Sea. The obtained values are compared with the similarities and the differences between the other species of the dolphins which live on the other coasts of the Black Sea and the oceans.

## 1. MATERIAL AND METHOD

The materials that were obtained from drowned by gill nets or stranded ashore on the eastern coast of the Turkish Black Sea. In total, 119 short beaked common dolphins consisting of 67 female and 52 male were measured by certain criteria for this study.

For each dolphin, the drafting criteria that were determined according to previously published literatures (Palacios et al, 2004; Gol'din, 2005) were numbered and showed at figure 2. They were measured by tape measure and callipers whenever possible.

## 2. RESULTS AND DISCUSSIONS

During the study, 119 *Delphinus delphis* were examined on the eastern coast of the Black Sea. Female common dolphins were ranged in TBL from 107 to 167 cm (n = 67) and the average TBL of the female was 158,86 cm. On the other hand male common dolphins were ranged in TBL from 103 to 190 cm (n = 52) and the average TBL of the male was 160 cm. As a result, the total body length of the Black Sea common dolphin is lower than the other regions. The flipper width of female common dolphins were measured from 6,3 to 10,2 cm and the average data was 8,95 cm. For male common dolphins, these data were measured from 6,8 to 11 cm and the average data was 9,3 cm on the eastern coast of the Black Sea. The fluke width of female common dolphins were measured from 23,5 to 43,5 cm and the average point was 34,98 cm. The fluke width of male common dolphins were measured from 21 to 48,5 cm and the average point was 36,15 cm. The dorsal fin height and base length of female common dolphins were measured from 9,3 to 18,3 cm and between 13,7 with 23,5 cm. These measurements for male common dolphins were 10,5 - 22 cm and 13,5 - 26,5 cm on the eastern coast of the Black Sea.

The female common dolphins in this study showed their body weight lower than the male common dolphins. On the contrary the average point of UJMC, WBH, LGS, BCDF and UJME of the female common dolphins are higher than the male common dolphins.

However in the eastern North Atlantic Male common dolphin's total body length were measured from 105 to 244 cm (Murphy et al, 2006), in the western coast of the Turkish Black Sea, the body length of the common dolphin was measured at 151 cm (Tonay and Öztürk, 2003). A male common dolphin was 214 cm in total length in the eastern tropical Pacific (Palacios et al, 2004). Female common dolphins ranged in total body length from 93 to 230 cm (Murphy et al, 2006). Mean total body length for male and female harbour porpoises were measured 164,4 cm and 173 cm in France. At their minimum 153 cm and maximum 176 cm for males and minimum 153 cm and maximum 190 cm for female harbour porpoises (Viaud-Martinez et al, 2007). The flipper width of a male short beaked common dolphin was scaled score 9,3 cm on the eastern Pacific. On the eastern Pacific the fluke width of a male short beaked common dolphin was measured at 49 cm. On the eastern Pacific the dorsal fin height and the dorsal fin base length of a male short beaked common dolphin was 15,5 and 43 cm (Palacios et al, 2004).

### 3. CONCLUSIONS

In conclusion, with this study, morphometric characters of the short beaked common dolphin on the eastern coast of Turkish black sea were examined. According to obtained findings, it was suggested that the Black sea's common dolphin was quite smaller to that of the ocean's forms. It is considered that this study will both be a refence in veterinary anatomy, and help researchers that are studying marine biology.

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Table 1

**Body measurements for female and male short beaked common dolphin from the eastern coast of the Black Sea**

	n	min-max (cm)	mean (cm)	Standard deviation	n	min-max (cm)	mean (cm)	Standard deviation
	♀				♂			
<b>TBL</b>	67	107-167	158,86	16,38	52	103-190	160	21,83
<b>PPL</b>	67	38-40	37,75	2,47	51	29-43	38,12	3,08
<b>WFL</b>	67	23,5-43,5	34,98	4,49	52	21-48,5	36,15	6,74
<b>LWTF</b>	67	8,5-13,1	11,51	1,08	52	7,8-14	11,71	1,52
<b>LPFU</b>	67	12,5-21,7	18,35	1,77	52	14-23	18,85	2,33
<b>LPFL</b>	67	18,5-28,7	25,55	2,22	52	19-31	26,18	2,91
<b>WPF</b>	67	6,3-10,2	8,95	0,78	52	6,8-11	9,3	1,01
<b>HDF</b>	65	9,3-18,3	14,75	1,78	50	10,5-22	15,76	3,07
<b>UJDF</b>	66	11-113,7	97,98	14,32	52	68,5-116	99,5	11,53
<b>UJEA</b>	67	25,5-37,5	32	2,18	52	23-35	32,03	2,53
<b>UJMC</b>	67	17,5-28	22,5	1,6	52	15-24,7	22,37	1,95
<b>UJEY</b>	67	18-29,3	26,49	1,90	52	20-29	26,7	1,96
<b>UJBH</b>	67	22,3-33	28,51	1,92	52	20-32,5	28,54	2,46
<b>TNAV</b>	67	28,5-51,5	42,72	4,55	52	28,5-51,5	43,01	6,78
<b>WBH</b>	66	1,4-2,7	1,91	0,25	50	1,4-2,4	1,87	0,2
<b>TDFNF</b>	66	42,5-82	69,28	8,61	51	46,5-94	73,27	12,41
<b>HDFNF</b>	66	44,5-85	71,61	9,11	50	47,5-96	75,73	12,8
<b>HDFAM</b>	66	16,5-31	25,84	2,74	50	11,5-35,5	26,68	5,09
<b>LDFB</b>	65	13,7-23,5	19	1,87	50	13,5-26,5	20,13	3,36
<b>LGS</b>	67	3,5-14	7,77	1,63	51	3-11	5,65	1,86
<b>GSAN</b>	67	3-13	4,21	1,41	51	7-17	12,97	2,44
<b>UMAN</b>	65	23-51	40	5,98	52	24,5-52	40,54	6,6
<b>UJAN</b>	66	80-139	117,04	12,03	50	79-141	117,86	15,53

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<b>DLUJ</b>	67	0,2-1,4	0,70	0,26	51	0,2-2	0,77	0,39
<b>BCPF</b>	67	64-95	81,48	6,59	51	61-101	83,83	7,9
<b>BCDF</b>	67	67-122	99,52	11,91	52	11-130	97,62	18,08
<b>BCAN</b>	67	36-75	55,43	7,5	52	33-78	56,4	10,27
<b>UJME</b>	67	8,5-14,2	12,15	1,2	52	7-14	11,89	1,48
<b>BW</b>	50	19-98	60,48	17,38	23	18-87	53,63	17,75

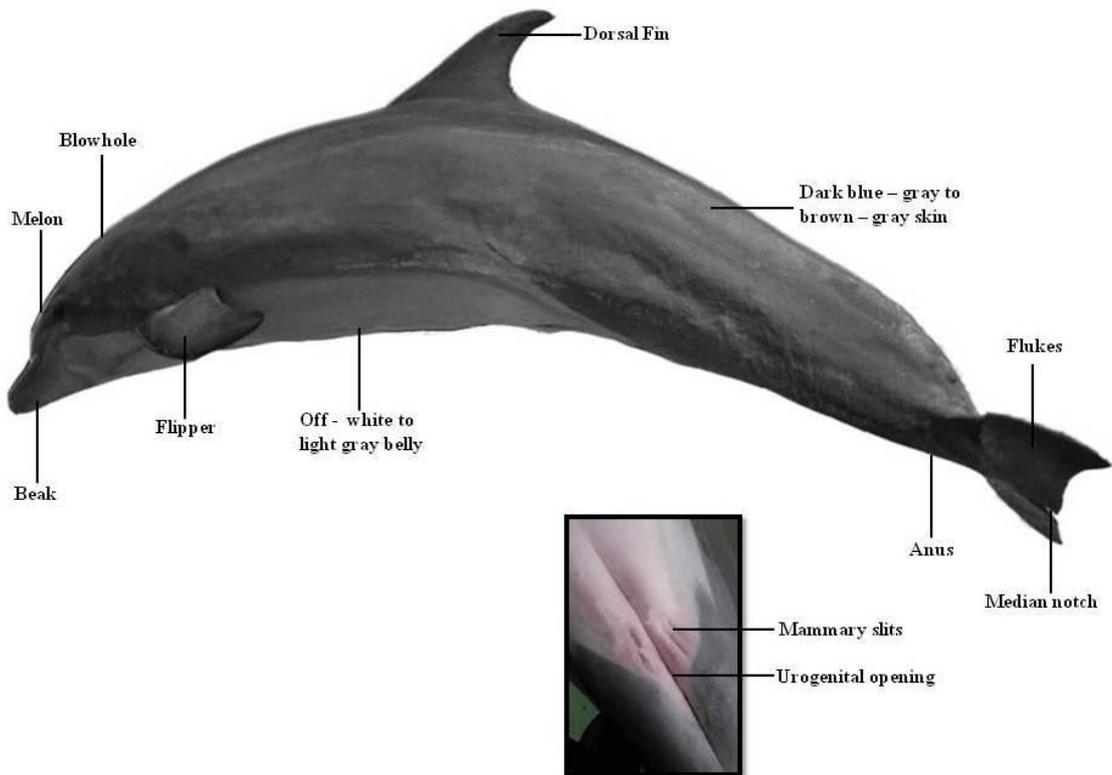


Figure 1: Anatomy of the short beaked common dolphin

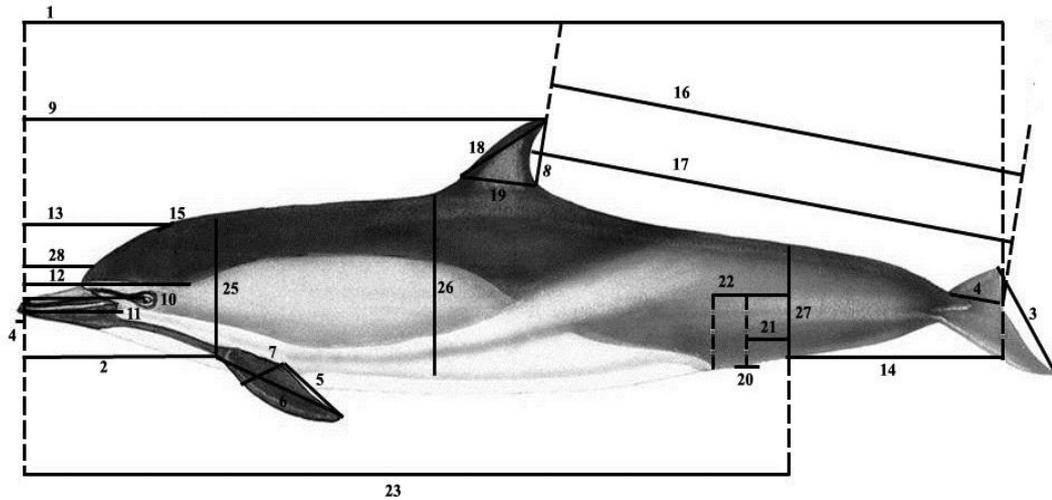


Figure 2: Measuring range on the schematic design: 1- total body length (TBL), 2- prepectoral length (PPL), 3- width of flukes (WFL), 4- longitudinal width of the tail fin (LWTF), 5- length of pectoral fin along the upper margin (LPFU), 6- length of pectoral fin along the lower margin (LPFL), 7- width of the pectoral fin (WPF), 8- height of dorsal fin (HDF), 9- distance from the tip of upper jaw to dorsal fin (UJDF), 10- distance from the tip of upper jaw to ear fin (UJEA), 11- distance from the tip of upper jaw to mouth corner (UJMC), 12- distance from the tip of upper jaw to eye (UJEY), 13- distance from the tip of upper jaw to blowhole (UJBH), 14- distance from the tail notch to anal vent (TNAV), 15- width of blowhole (WBH), 16- distance from tip of dorsal fin to the notch of flukes (TDFNF), 17- distance from hind end dorsal fin to the notch of flukes (HDFNF), 18- height of dorsal fin along the anterior margin (HDFAM), 19- length of dorsal fin of the base (LDFB), 20- length of the genital slit (LGS), 21- distance from the genital slit to anus (GSAN), 22- distance from umbilicus to anus (UMAN), 23- distance from the tip of upper jaw to anus (UJAN), 25- body circumference at the anterior and of pectoral fin (BCPF), 26- body circumference at the anterior and of dorsal fin (BCDF), 27- body circumference at the anus (BCAN), 28- distance from the upper jaw to anterior of melon (UJME)

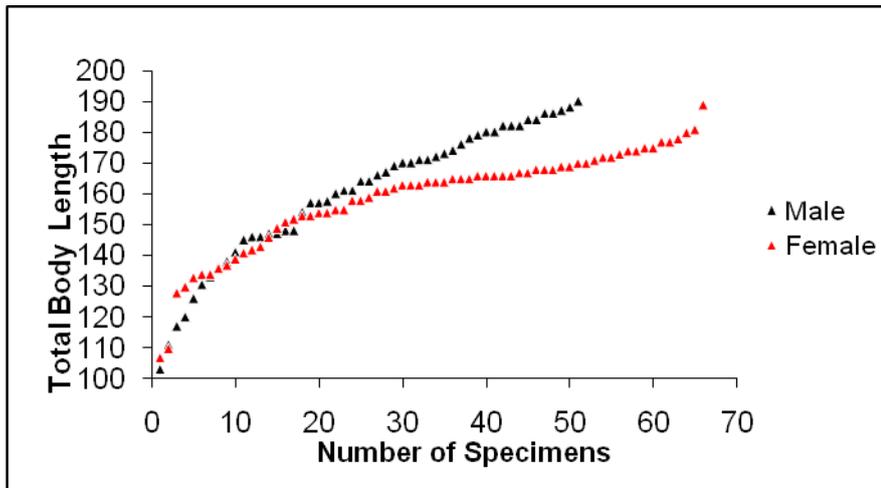


Figure 3: Graphical analysis of the total body length of the specimens

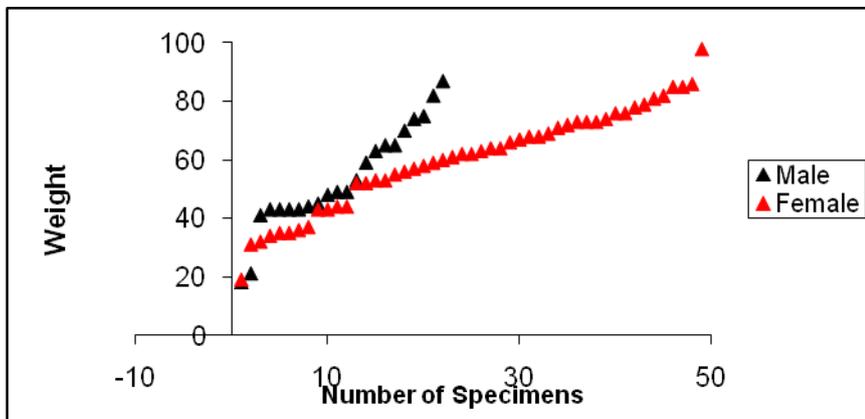


Figure 4: Graphical analysis of the weight of the specimens

## THE EFFECT OF BREED, BODY CONDITION SCORE AND AGE OF EWE ON THE REPRODUCTIVE PERFORMANCE OF EWES IN BREEDING SEASON

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**Key words:** Kıvrıkcık, Sakız, Gökçeada, body condition score, fertility, litter size.

### SUMMARY

This study was carried out to investigate breed, condition score category and age of ewe on the reproductive performance of ewes in breeding season. The animal materials were comprised 156 ewes of different ages and genotype and kept at Marmara Livestock Research Institute, Bandırma, Turkey.

Fertility for Kıvrıkcık, Sakız and Gökçeada ewes were 0.83, 0.87 and 0.74 and were 1.44, 1.70, and 1.79 lamb/ewe litter size, respectively. The breed effects were not significant ( $P>0.05$ ) on fertility, but significant on litter size ( $P<0.01$ ). Gökçeada ewes had the lowest fertility ( $0.743\pm 0.062$ ) and Sakız ewes had the highest fertility ( $0.870\pm 0.056$ ). On the other hand, litter size was the lowest with Kıvrıkcık sheep breed (1.43) and it was the highest with Gökçeada breed (1.78). According to BCS categories at 1 unit intervals, significant differences were observed only for fertility ( $P<0.05$ ), which gave highest values of between 3 and 5 for BCS. The age of ewes were significant on fertility ( $P<0.05$ ) and litter size ( $P<0.01$ ). Also, the effect of ewe age at mating on fertility and litter size was the lowest with age of ewe 3 (0.62) and 2 (1.39), while it was the highest with age of ewe 6 (0.907) and 6 (1.906). In conclusion, the BCS at mating, age of ewes and breeds seemed to affect fertility and litter size.

Small ruminants breeding represent one of the most significant agricultural activities in the world and it plays a fundamental role on economic, ecological, environmental and cultural levels. Similar to in the world our sheep breeding have an important role in animal production. Sheep have the ability to transform poor grasslands, which are widespread in Turkey, into valuable products like meat, milk, wool and skin. The sheep population is about 95% of unimproved indigenous breeds in Turkey (Yılmaz et al., 2003, Akman et al., 2001; Kaymakçı and Sönmez 1996). Despite the high number of studies on indigenous breeds, there is almost no long term improvement study on these breeds. In fact, lack of such studies constitutes the main reason for our failure to accurately determine the performances of the breeds. Reproductive performance is the most important factor influencing efficiency in sheep breeding. Reproductive performance can be defined based on different measures which is determined by the environmental factors that comprise genetic structure, feeding, live weight, age, lambing season, individual differences, care and flock management (Ada et al., 2004).

Body condition score and its utilization are important in terms of attaining the desired performance for certain physiological periods in sheep breeding where extensive conditions are dominant. It is indicated that there might be differences among values for different physiological periods of genotypes bred in our country and that basic studies for determining these values should be carried out. (Biçer, 1991).

During mating, sheep in condition, compared to others, demonstrate a higher value in terms of reproductive performance. Accordingly, determination of a body condition of the sheep in the flock and improving this body condition to optimal level during mating results in quantitative improvements in lamb efficiency (Sezenler et al., 2007).

It is known that, in sheep breeding, feeding practices applied in different physiological periods have consecutive effects. In other words, conditions that have to be satisfied in relation to feeding are determined not only by the nutritional requirements specific for that period but also by the minimum nutritional balance that the organism should have in order to achieve the desired performance in the subsequent physiological period (Özder et al., 1997).

In recent years, many researchers have started to discuss the significance of body fat reserves for female sheep during the mating period as well as its relation with the reproductive performance in the short and middle terms. In practice, while the fat reserve levels are estimated using live weight and BCS, it has been demonstrated that it improves efficiency in sheep of different breeds and there is a positive correlation between the fat reserve level and ovulation rate (Russel et al., Ark., 1969; Merrel, 1990; Forcada et al., 1990; Barth and Neumann, 1991; Atti and Abdennebi, 1994; Molle, 2001).

Due to its ease of use, BCS has become a widely accepted and recommended indicator for determining the nutritional conditions of sheep (MLC, 1981).

In practice, the recommended BCS for success in the mating period is around 3-3.5. utilization of BCS had the important contribution in terms of reproductive performance, flock management and observing feeding practices in flocks under challenging grazing conditions and in terms of developing correlations between them (Gibon, 1985).

The objectives were to study the effects of different body condition scour, breeds, and age of ewe at mating on ewe fertility and litter size performance.

## 1. MATERIAL AND METHOD

### **Animal Material**

The animal material in the study is consisted of three different Turkish native sheep breeds which are 53 head of Sakız, 43 head of Gökçeada, and 60 head of Kıvrıcık ewes and their ages were between 2 to 6 years old. The sheep flocks were bred at Marmara Livestock Research Institute, Bandırma, Turkey.

Kıvrıcık, Sakız and Gökçeada ewe flocks were kept in separate free box and inside the wandering areas in front of these sections and they were not released to the pasture during the mating period. This period, they had clean and fresh water in front of them and were fed twice a day, once in the morning and once in the evening. The ewes of flocks were given 600 gr/head/day concentrate feed and 600 gr/head/day of forage. The concentrated feed mixtures were contained 2613 ME kcal/kg and 15% crude protein. It is contained 55% barley, 18% wheat 13.9% sunflower meal, 18% wheat bran, 2% marble dust, 1.0% salt and 0.1% mineral and vitamin mix. All born lambs were identity with ear tagged (within 12 hour of the birth) and kept separately with their dams in separate stalls for 3 days after lambing. The lambs were allowed to suckle their mothers twice a day.

### Method

The ewes were mated naturally in the breeding season. It consists of 45-60 day starting from 15th September to 15th November and was used total of 9 rams, 3 for each breed. The BCS was at mating season recorded using the approach described by Russel et al., (1969). Body condition scores were given by four different researchers at the start of the mating season. Fertility and litter size were evaluated with the start of the lambing.

The analysis of all data was performed using General Linear Models (GLM) procedure with SAS software (SAS 1998). Duncan's multiple-range test was used to compare treatment means.

## 2. RESULTS AND DISCUSSIONS

The effect of body condition score and age of ewe at mating on fertility and litter size are given in Table 1. Kivırcık, Sakız and Gökçeada ewes were  $0.833 \pm 0.059$ ,  $0.870 \pm 0.056$  and  $0.743 \pm 0.062$ , respectively while their effect on fertility was statistically insignificant ( $P > 0.05$ ) and lamb efficiency litter size were  $1.435 \pm 0.096$ ,  $1.698 \pm 0.087$  and  $1.785 \pm 0.104$  and they were found to be statistically significant ( $P < 0.01$ ).

According to the Table 1, the lowest lambing rate was attained by the group with the lowest body condition score of 2 and the highest one was attained by the group with the score of 3 ( $P < 0.05$ ). Its effect on the litter size was lowest in the group with the condition score of 3 ( $1.647 \pm 0.107$ ) and it was highest on the group with the condition score of 5 ( $1.656 \pm 0.109$ ) and it is statistically insignificant ( $P > 0.05$ ).

Table 1

The fertility and litter size of the Kivırcık, Sakız and Gökçeada ewes

Factors investigated	Fertility		Litter Size	
	n	$\bar{X} \pm Sx$	n	$\bar{X} \pm Sx$
Breeds		NS		**
Kivırcık	60	$0.833 \pm 0.059$	51	$1.435 \pm 0.096$ a
Sakız	53	$0.870 \pm 0.056$	46	$1.698 \pm 0.087$ b
Gökçeada	43	$0.743 \pm 0.062$	31	$1.785 \pm 0.104$ b
Body Condition Score		*		NS
2	23	$0.668 \pm 0.085$ a	14	$1.737 \pm 0.154$
3	34	$0.890 \pm 0.068$ b	29	$1.647 \pm 0.107$
4	55	$0.847 \pm 0.052$ b	36	$1.518 \pm 0.083$
5	44	$0.857 \pm 0.070$ b	39	$1.656 \pm 0.109$
Age of Ewe		*		**
2	29	$0.831 \pm 0.074$ ab	24	$1.394 \pm 0.120$ a
3	41	$0.621 \pm 0.059$ a	27	$1.516 \pm 0.108$ ab
4	34	$0.820 \pm 0.065$ ab	28	$1.598 \pm 0.106$ abc
5	17	$0.900 \pm 0.093$ b	16	$1.783 \pm 0.140$ bc
6	15	$0.907 \pm 0.065$ b	23	$1.906 \pm 0.100$ c
Mean	156	$0.816 \pm 0.033$	128	$1.639 \pm 0.054$

a, b,c: The differences among the means of groups carrying various letters in the same column are significant.

\*  $P < 0.05$ , \*\*  $P < 0.01$ , NS: :non significant

These results are similar to those obtained by Gunn et al., 1969, Gunn et al., 1979, Newton et al., 1979, Newton et al., 1980, Thompson and Bahaddy, 1988, Dedieu, 1992, Gonzales et al., 1997 and Sezenler et al., 2007. However the studies conducted by Laster et al., in 1972, Adalsteinsson in 1979; Atti and Abdennebi in 1995 do not demonstrate similar increases.

When the effect of mating age on fertility is analyzed, it is seen that the effect is lowest on the group aged 3 ( $0.621\pm 0.059$ ) and it is highest on the group aged 6 ( $0.907\pm 0.065$ ) and it is statistically significant ( $P<0.05$ ). On the other hand, the effect of mating age on the litter size was lowest in the group aged 2 ( $1.394\pm 0.120$ ) and it was highest in the group aged 6 and it is statistically significant ( $P<0.01$ ). Fertility and lamb efficiency litter size display an increasing trend with higher age. These results are similar to those obtained by Dhingra and Botkin, 1982, Patkowska Sokola and Barczynska, 1985, El Karim and Owen, 1987, Urruita et al., 1988, Ada et al., 2004 and Sezenler et al., 2007.

### 3. CONCLUSIONS

In general, the findings of this study are parallel to those indicated in the literature. A difference was observed among the breeds, particularly in terms of the litter size and this was an expected result. The main factors behind this result are different genotypes of the breeds, breeding locations and differences in purpose of breeding, and the fact that Sakız breed sheep are more prolific compared to the other two breeds. There is a certain level of the increase in the fertility parallel to the increase in the body condition score. However it could not be observed the same increase in the number of lambs per lambing sheep. The fact that Sakız breed sheep, despite their lower conditions, produced more multiple lambs in a single lambing compared to other breeds was the reason behind this observation. As expected before, age was positively correlated with both of the Reproductive performance properties. As a result, it is understood that, in all of our local breeds, body condition score is particularly important in terms of physiological periods and that it should be used. Additionally, it was concluded that Kıvırcık and Gökçeada breeds should enter mating at a condition level of 3-4 body condition score while Sakız breed should be 2-3 condition score before naturally mating season.

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**INDUCING AND STARTING THE PARTURITION IN SWINE WITH THE  
MEDICINAL PRODUCT REGLANDIN D- (+) - CLOPROSTENOL,  
SYNTHESIS ANALOGUE OF NATURAL PROSTAGLANDINES F<sub>2</sub>A**

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**Key words:** prostaglandin, luteolyse, biotechnology, pregnancy, parturition.

### SUMMARY

The studies made by us are based on fundamental biological role of prostaglandines modulator of hormonal actions, influxes nerve transmission and cellular ionic exchanges. One of the main action of PGF<sub>2</sub>α is luteolyse, a process that includes both the secretion of progesterone and regression yellow body. PGF<sub>2</sub>α is a luteolytic for most of the species: cow, buffalo, sow, mare, sheep, rabbits, guinea pigs, hamsters and rats, except primates. At present it is considered that PGF<sub>2</sub>α have their specific receptors, which are fixed and through their model would enable guanidine mono-phosphate cyclic or GMP's Goldberg. The ocitocic and luteolytic effect represents the pharmacodynamic base of PGF<sub>2</sub>α use in breeding biotechnologies and hormonal therapy. In medicine veterinary prostaglandins are used after 1973.

Prostaglandins are biologically active substances which act in both the vegetable and the animal kingdom.

Prostaglandin formation in the body occurs in the endoplasmic reticulum endometrial cells, vesicular-seminal, lung, etc. Under the action of phospholipase A2 in cell membrane phospholipids release of essential fatty acids (EGA), linoleic and arachidonic specifically. Arachidonic acid under the action of PG synthesize ultimately resulting peroxo compounds, as PGG<sub>2</sub> endoperoxizi rectum and PGH<sub>2</sub>, which is derived from the PGF<sub>2</sub>α.

Half-life of endogenous PG, respectively luteolisina from uterus, is extremely short for 1-3 minutes. For synthesis prostaglandins, for example Cloprostenol inoculated i.m. half-life is approximately 60 minutes and 90% inactivated in the liver following a single blood flow and 10% is eliminated in lungs and kidney (5). Around birth, PGF<sub>2</sub>α accumulates in amniotic fluid, maternal placenta, blood and miometru.

It can be concluded that structural changes PGF<sub>2</sub>α synthesis induce

pharmacodynamic qualitative changes, for example-cloprostenol is 200 times more luteolytic in cattles comparative to natural prostaglandin and therefore doses 50-200 times lower than those of natural PG - (5,6,14,17).

### 1. MATERIAL AND METHOD

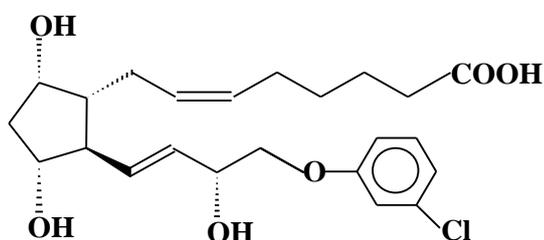
The researches have been carried out in oct.-dec. 1999 at SC Romsuintest SA Peris, on 24 pregnant sows from Synthetic Line -345-Peris.

The purpose was to retest the veterinary medicinal product REGLANDIN a synthetic analogue of natural prostaglandin F2 $\alpha$ , which has the active ingredient sodium salt of D-(+) - cloprostenol, produced by the National Institute for Chemical-Pharmaceutical Research and Development (ICCF) - Bucharest and is part of the prostaglandin class (6,14) is registered and marketed by SC ZOOVET IMPEX SRL, Bucharest.

Chemical Name 1-D-(+) - cloprostenol is an acid R - [1 (Z), 2b (1E, 3R \*), 3a, 5a] - (+) - 7 - [2 - [4 - (3 - clorofenoxi) - 3 - hydroxy - 1 - butenil] - 3.5 - dihidroxiciclopentenil] - 5 - heptenoic used in drug industry.

1. Molecular Formula: C<sub>22</sub>H<sub>29</sub>O<sub>6</sub>Cl;

2. Structural Formula:



How induction of smooth muscle fiber contraction, the uterus in particular was highlighted by Ramwell and Shaw in 1970 (1,2,16).

As is known not only PGF<sub>2</sub> $\alpha$  luteolytic effect, they are also the most powerful oitocice encountered in the clinic. Thoburn and Currie 1973 cited by Knape, V. Paraipan in 1980 and 1982 considers that the contractile action occurs due to the modulation exerted by PG on AMPc formation, which intervenes with the permeability of cell membrane hyperpolarized and relaxing and contracting the fiber or fiber membrane depolarized myometrial , ie the increase or decrease the formation of AMPc(15).

Induction and synchronization of parturition in sows using prostaglandin analogues or synthetic, as Angela Maria Stoica et al.-2003(16) has the following advantages: management, economic of sanitary veterinary (7,9,10,11,12,13).

Our researches focused on the new range of applications prepared prostaglandins, their selectivity in the field of swine breeding and have followed the clinical, biological was drafted and testing protocols. Biological material: clinical testing of veterinary medicinal product to REGLANDIN done on two groups of 24 animals of the SC pigs ROMSUINTEST S.A. Peris, in Ilfov county, divided as follows:

- Experimental group - Lot-ES1 was composed of 14 pregnant sows, they were inoculated im REGLANDIN 1 ml (0.075 mg D-(+) - cloprostenol) / per sow, the 113th day of gestation;

- Experimental group-Lot-ES2-comprising 10 pregnant sows, they were inoculated im REGLANDIN 1 ml (0.075 mg D-(+) - cloprostenol) / per sow, the 114th day of gestation; ES2-consists of 10 sows in the gestation of 114 days;

-Lot M (blank) - Forms of 52 sows were allowed to naturally birth in term. When taken in the experimental sows were a record which included individual identifiers (nr. matricol), race, age of gestation, actions taken and their consequences, and before in administration Reglandin of 1 ml (0.075 mg D-(+) - cloprostenol) / per sow and were recorded: local and general tolerance, the emergence of any adverse reactions, tachypnea, tachycardia, decreased appetite, transpiration, temperature, time of onset is also downgrading parturition followed, noting the date, hour and minute, number of live piglets and deaths, placental retention were possible endometritis. Finally all were tracked and highlighted clinical manifestations, including possible side effects.

Blood-sampling were done immediately before of administration REGLANDINULUI and was repeated after 24 hours and 48 hours after administration on EDTA for hematological examination performance at VMF-Bucharest, to be determined following parameters: WBC ( thousands / ml), lymphocytes, monocytes, granulocyte, lymphocytes, monocytes, granulocytes, RBC , hemoglobin , hematocrit, MCV, HEM , MCHC, platelets, eosinophils, and coagulation on coagulation activator with blood biochemical parameters : glucose, GPT, GOT, urea, creatinine, alkaline phosphatase, pancreatic amylase, estrogen and progesterone.

The objectives were:

- 1 – The dynamic of starting parturition;
- 2 - Parturition duration;
- 3 - Number of obtained products (live and dead) and their viability;
- 4–The incidence of puerperal disorders.

## 2. RESULTS AND DISCUSSIONS

From the bulletins issued by MVF Bucharest it can be seen that most of the values of blood parameters were within physiologic normal limits and only a small part was registered small deviations. It results that the health status of studied females was appropriate.

Following administered i.m. of 0,075 mg (1 ml) / sow sodium salt D-(+)-cloprostenol, all females' injected experimental groups (ES1 + ES2) triggered parturition.

**Objective 1.** The dynamic of starting parturition from PGF2 alfa is represented in Figure 1

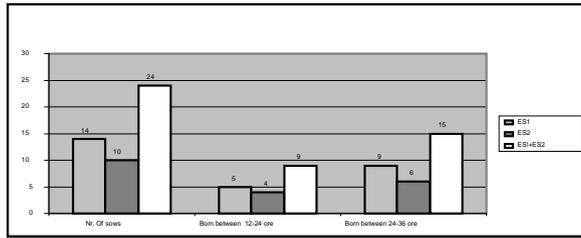


Figure 1. The dynamic of starting parturition from PGF2 alfa

The analysis found that graphics were the following:

1. In a number of 9 females calving occurred between 12- 24 hours after PGF2 $\alpha$  (Reglandin) injection;
2. In a number of 15 females calving occurred between 24-36 hours after injection of PGF2 $\alpha$ .

- ES1 group consisting of 14 females were injected at 113 days of gestation and all have started calving in a mean of 25 hours and 27 minutes (12 h and 47 minutes and 35 h and 20 minutes);

- ES2 group, consisting of 10 sows were injected at 114 days of gestation, parturition triggered by a mean of 25 hours and 23 minutes (12h, 56 minutes and 31h, 55 minutes);

- The 24 females of experimental groups were interval ES1 + ES2 average time from inoculation to induce parturition PGF2 $\alpha$  for 25 hours and 25 minutes.

**Objective 2.** The duration of parturition after injecting PGF2alfa (Regalndin) appears in Figure. 2.

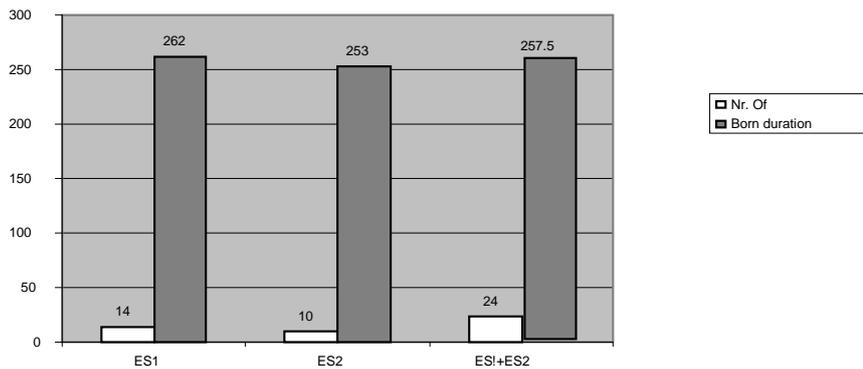


Figure 2. The duration of parturition after injecting PGF2alfa (Regalndin)

Looking at this graphic was found as follows:

- ES1 group consisting of the 14 pregnant sows in the 113-day, a group led births in the first 24 hours after inoculation, 5 (35.71%, with a range between 21 to 24 hours, with an average of 25 hours and 27 minutes and with 9 (64.42%) calving, with a range of between 24-36 hours, and the average duration of parturition was by 262 minutes;

- ES2 group, consisting of 10 pregnant sows inoculated in a 114-day, resulted in clustering of births in the first 36 hours after inoculation, 4 (40 %) between 12 to 24 hours

and with 6 (60%) giving birth between 24-36 hours, and the average duration of parturition was by 253 minutes;

- It can be seen that the average interval from administration to all females 24(ES1-14+ ES2-10) REGLANDIN (D-(+)-cloprostenol) 1ml (0.75mg) / sow is **257 minutes**, unto 156 minutes, after Randall, quoted by A. T. Bogdan(3,8).

**Objective 3.** The obtained number of piglets after parturition, which is apparent from Table no 1.

Table 1

#### Number of piglets after parturition

- **ES1**-formed group of 14 sows, the piglets received a total of 142 (**10.14 / sow**), of which 131 - piglets (9.35/sow) and 11 dead piglets (0.78/sow)

- **ES2**-group - made up of 10 sows, scored a total of 113 piglets (**11.3 / sow**), of which 106 piglets (10.06 / sow) and 7 piglets died (0.70 / sow)

- Comparing the two groups together, we conclude that the ES2 group

obtained an average live pig in addition to group ES1;

- **M-group** consists of 52 sows, the piglets received a total of 548 (**10.53 / sow**), of which 485 piglets (9.32 / sow) and 63 piglets deaths (11.49 / sow)

- Comparing the two experimental groups (ES1 + E2), which obtained a total number of 255 piglets (10.62 piglets per sow), respectively 237 live (9.87 live / dead pig and 18 (0.75 / pig), compared with M group obtained a total of 548 pure (10.53 piglets per sow) 485 respective live (live 9.32/sow) and 63 deaths (1.21/sow). It can be counted as between experimental and control group significant there were no differences in terms of number of live piglets per sow obtained on average 9.87 compared to 9.32 piglets how many there were in the control group and the average dead piglets in farrowing the experimental groups was 0.75, compared to 1.21 in the control group.

**Objective 4** The incidence of puerperal disorders, which are displayed in Table 2.

The analysis finds that this schedule is:

- Water retention of placenta was (2.63%) has fallen to the lot ES1;

- Metritis, 3 cases (3.94%) in groups M and group ES2;

- Mamitis, 2 cases (2.63%) in group M;

- No Milk, 4 cases (5.26%) in groups ES1 and M.

Table 2

#### Incidence of puerperal diseases

Lot	Nr. sow	Placenta Reten-tion	Metri-tis	Mamitis	Agalaxyes	TOTAL (%)
ES1	14	2	0	0	1	3-21,42
ES2	10	0	1	0	0	1-10
ES1+ES2	24	2	1	0	1	4-16,66
M	52	0	2	2	3	7- 13,46
TOTAL (%)	76	2- 2,63	3- 3,94	2- 2,63	4- 5,26	11- 14,47

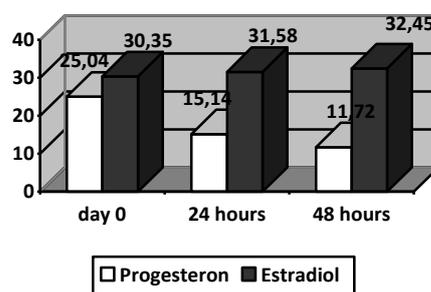


Figure 3. Values of progesterone (P4) and Estradiol before and after administration of 1 mg ml Reglandinului 0.075mgD-(+)cloprostenol) / sow gestation with 113 days

The average values of **progesterone (P4)** were before injecting Reglandine  $X = 27.29$  ng / ml (m = 9.2 and M = 28.8) ng / ml, and after 24 hours  $x = 14.51$  (m = 5, 1 and M = 24.8) ng / ml to decrease after 48 hours at  $X = 10.91$  (m = 3.4 and M = 23.6) ng / ml, compared with reference values between 10:30 ng / ml.

The average values of **estradiol** was before injecting Reglandine  $X = 30.68$  pg / ml (m = 19.3 and M = 42.4) pg / ml, and after 24 hours  $x = 32.33$  (m = 22.7 and M = 435) pg / ml, to increase after 48 hours at  $X = 33.29$  (m = 23.1 and M = 43) pg / ml, compared with reference values between 10 and 50 pg / ml.

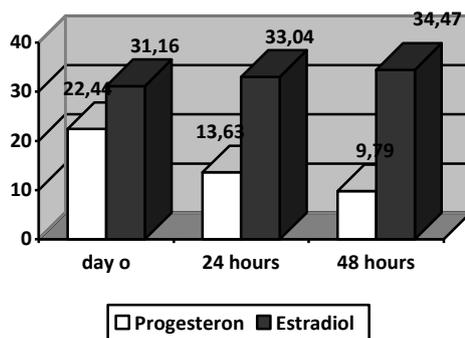


Figure 4. Average Values of progesterone (P4) and Estradiol before and after administration of 1 ml Reglandinului (0,075 mg D-(+)-cloprostenol) / sow gestation with 114 days.

The average values of **progesterone (P4)** were before injecting Reglandine  $X = 22.44$  ng/ml (with limits from 9.2 to 28.4) ng/ml, and after 24 hours  $x = 13.63$  (5.1 limits -19.1) ng / ml to decrease after 48 hours at  $X = 9.79$  (limits 3.4 -13.3) ng/ml, compared with reference values ranging between 10 and 30 ng/ml.

The average values of **estradiol** was injected immediately before Reglandine  $X = 31.16$  pg / ml (with limits from 19.3 to 42.4) pg / ml, and after 24 hours  $x = 33.04$  (22.7

-39 limits , 5) pg / ml, to increase after 48 hours at  $X = 34.47$  (with limits 23.1 to 43.7) pg / ml, compared with reference values between 10 and 50 pg/ml.

### 3. CONCLUSIONS

1. After administration of 1 ml i.m. Reglandine sterile solution of sodium salt at a dose of 0,075 mg / sow average interval of time from injection to parturition induction is as follows, all 24 females injected period average time was 25 hours and 25 minutes;
2. Average duration of parturition was average at the two groups (ES1 + ES2) was 257.5 minutes;
3. It can be seen that between the experimental and control group there were no significant differences regarding the number of live piglets per sow obtained on average 9.87 compared to 9.32 piglets how many there were in the control group, while the average dead piglets calving was 0.75 experimental groups compared with 1.21 in the control group.
4. The incidence of postpartum disorders: there have been two cases of placental retention (2.63%) in group ES1 - 3 cases (3.94%) and group ES2 lots metritis, mammites 2 cases (2.63%) in group M and no milk 4 cases (5.26%) in groups ES1 and M.
5. Where it can be concluded that the health of sows studied was appropriate as following parameters values determinate hematological examination is within normal limits, with some exceptions.
6. The average values of progesterone (P4) were :
  - before injecting Reglandine (P4) -  $X = 27.29$  ng / ml;
  - and after 24 hours(P4) -  $X = 14.51$  ng / ml to decrease;
  - after 48 hours at(P4) -  $X = 10.91$  ng / ml.
7. The average values of Estradiol was:
  - before injecting Reglandine- Estradiol la ES1-  $X = 30.68$  pg / ml and at ES2  $X = 31,16$  pg / ml;
  - after 24 hours Estradiol la ES1- $X = 32.33$  pg / ml and ES2- $X = 33,04$  pg / ml;
  - after 48 hours Estradiol la ES1- $X = 33.29$  pg / ml and ES2- $X = 34,47$  pg / ml compared with reference values between 10 and 50 pg / ml.
8. In the sows treated with 1 ml Reglandin-0.075 mg sodium salt of D-(+)-Cloprostenol/ sow, no adverse reactions were detected.

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**COMPARISON OF PRID + PGF<sub>2α</sub> + GnRH AND GnRH + PGF<sub>2α</sub> + GnRH PROTOCOLS IN THE TREATMENT OF POSTPARTUM ANESTRUS COWS\***

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**Key words:** PRID, GnRH, PGF 2alfa, Postpartum Anestrus, Cow

**SUMMARY**

The objective of this study was to determine the effects of two protocols on fertility parameters of postpartum anestrus cows. Fifty postpartum anestrus cows were used as material of the study. In Group 1 (n: 25), postpartum anestrus cows received PRID on Day0 with oestradiol benzoate (10 mg, vaginal capsule) and PGF<sub>2α</sub> injection on Day8 and GnRH injection on the Day9. The PRID was removed on Day9 and cows were inseminated after the detection of estrus. In Group 2 (n: 25), postpartum anestrus cows received GnRH on Day0, PGF<sub>2α</sub> on Day7 and GnRH on Day9. Cows were inseminated after the detection of estrus. 2.15 ± 0.98 and 1.05 ± 0.56 days were found between the end of the treatment and time of behavioral estrus in group 1 and 2, respectively. The percentages of estrus detection were 83.3% (20/24) in group 1 and 68% (17/25) in group 2 (p>0.05). The pregnancy rates after artificial insemination were 60% (12/20) and 47.05% (8/17) in group 1 and 2, respectively (p>0.05). There was not a statistical significant difference between estrus rates and pregnancy rates in group 1 and 2. As a result, the effects of two protocols in postpartum anestrus cows increased the reproductive performance; furthermore it was effective in regulation of cycle and observation of estrus.

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The postpartum period plays a pivotal role in cattle reproduction. The duration of postpartum anestrus has an important influence on reproductive performance (Peter et al., 2009). The early resumption of normal ovarian activity accompanied by visible estrus symptoms is essential for the optimal calving interval of 365 days (Zduńczyk et al. 2002; McLeod and Williams 1991; Schmidt 1989). Post-partum anestrus, defined as a lack of estrus until 60 days post-partum, is the major factor causing elongation of this interval and, in consequence, substantial economic losses (Lamming 1980; Mwaanga and Janowski 2000; Senger 1994). Incidences of postpartum anestrus may vary among herds from 10 to 40% (Zduńczyk et al. 2002; Martinez and Thibier 1984; Mwaanga and Janowski 2000). It has been suggested that in high-yielding dairy herds, there is increased incidence of anestrus (Berger et al. 1981; Etherington et al. 1991; Opsomer et al. 1996). Perhaps increased partitioning of energy to milk production can result in anestrus by delaying resumption of ovarian activity. However, factors such as limited energy intake, lower body reserves, and postpartum diseases can also delay the return to cyclicity (Peter et al., 2009).

There are four clinical forms of anestrus: (1) silent heat; (2) cystic ovarian disease; (3) ovarian afuction; (4) *corpus luteum pseudograviditatis* (Zduńczyk et al.

2002; Mwaanga and Janowski 2000). Rectal palpation is a main method used for clinical evaluation of ovarian activity in dairy herds, but it may cause high proportion of misdiagnosed and incorrectly treated animals (Zduńczyk et al. 2002; McLeod and Williams 1991). False diagnoses can be avoided by ultrasound scanning or progesterone determination in milk or blood (Kalis and Wiel, 1980; Pieterse et al. 1990).

Researchers have treated postpartum anestrus cows with progesterone (Hatler et al. 2006) or with concurrent GnRH followed by PGF<sub>2α</sub> (Ambrose et al. 2004). In the treatment of postpartum anestrus, combination of GnRH and PGF<sub>2α</sub> can also be used (Day 0, GnRH; Day 7, PGF<sub>2α</sub>; and Day 9, GnRH), with or without timed-insemination (Ambrose et al. 2004; Crane et al. 2006)

The objective of this study was to determine the effects PRID + PGF<sub>2α</sub> + GnRH and GnRH + PGF<sub>2α</sub> + GnRH protocols on fertility parameters of postpartum anestrus cows.

## 1. MATERIAL AND METHOD

This study was conducted on 50 Holstein cow in five commercial dairy herds, located in Ankara provinces in Turkey from January to July 2009. 50 Holstein cows which did not show estrus cycle until the 60<sup>th</sup> day of postpartum were controlled by rectal palpation and included this study as postpartum anestrus cows. 50 Holstein cows which did not show estrus until the 60<sup>th</sup> day of postpartum are divided into 2 groups. In group 1, postpartum anestrus cows received PRID® (1.55 gr. Progesterone; Sanofi Doğu İlaç, Ankara, Turkey) on Day0 with oestradiol benzoate (10 mg, vaginal capsule) and PGF<sub>2α</sub> (Iliren, Farma Intervet) injection on Day8 and GnRH (**Receptal**® inj., 0.0042mg buserelin asetat/ml, Intervet Ltd., Istanbul, Turkey) injection on the Day9. The PRID was removed on Day9 and cows were inseminated after the detection of estrus. In Group 2 (n: 25), postpartum anestrus cows received GnRH on Day0, PGF<sub>2α</sub> on Day7 and GnRH on Day9. Cows were inseminated after the detection of estrus. In both groups, cows which did not show estrus after the treatment were not included to the statistical analysis. The uterus of cows that could not be observed in estrus was palpated per rectum 45-50 days after insemination to determine pregnancy status. The differences in estrus rates and pregnancy rates between two protocol were analyzed by using Chi-square Test and SPSS 14,01.

## 2. RESULTS AND DISCUSSIONS

Consummately, 50 cows were used in the study. 25 of them were allocated in group 1 and 25 in group 2. In group 1, one PRID got lost in the study and group 1 was evaluated from 24 cows. Estrus rate and timing of estrus in group 1 and 2 are presented in Table 1.

Table 1

<b>Estrus rate and timing of estrus in group 1 and group 2</b>		
	<b>Estrus Rate</b>	<b>Timing of Estrus (Day)</b>
<b>Group 1 (PRID + PGF<sub>2α</sub> + GnRH)</b>	83,3% (20/24)	2.15 ± 0.98
<b>Group 2 (GnRH + PGF<sub>2α</sub> + GnRH)</b>	68% (17/25)	1.05 ± 0.56
<b>P</b>	(p>0.05)	

In group 1, 20 cows were detected in estrus and these cows were inseminated artificially. 12 cows were palpated as pregnant by rectal palpation 45-50 days after the artificial insemination in group 1. In group 2, 17 cows were detected in estrus and these cows also were inseminated artificially and 8 cows were palpated as pregnant by rectal palpation in group 1 45-50 days after artificial insemination (Table 2).

Table 2

<b>Pregnancy Rates at Day 45-50 in group 1 and group 2</b>	
	<b>Pregnancy Rates at Day 45-50</b>
<b>Group 1 (PRID + PGF<sub>2α</sub> + GnRH)</b>	60 % (12/20)
<b>Group 2 (GnRH + PGF<sub>2α</sub> + GnRH)</b>	47.05 % (8/17)
<b>P</b>	(p>0.05)

The main objective of this study was to compare the effectiveness of the PRID + PGF<sub>2α</sub> + GnRH and GnRH + PGF<sub>2α</sub> + GnRH protocols in the treatment of postpartum anestrus. The treatments of postpartum anestrus cows have been evaluated for estrus rates, timing of estrus and pregnancy rates and no statistically significant difference were found between estrus rates and pregnancy rates of groups in the study.

Timing of estrus was detected after 2.15 ± 0.98 day in group 1 and 1.05 ± 0.56 day in group 2 in this study. Xue et al. (1984) reported 52.0 ± 5.8 hours as a time of estrus after removal PRID and Ozyurtlu et al. (2008) reported 3.22 ± 0.97 days as a time of estrus in their study. In group 1, same results were observed after removal of PRID in postpartum anestrus cows. Aral and Colak, (2004) reported 62.6 hours after PGF<sub>2α</sub> injection as time of estrus in GnRH + PGF<sub>2α</sub> + GnRH protocol. Besides similar results were obtained in group 2.

Many researchers reported estrus rates between 66.7% - 93.3% in the studies of PRID (Kacar and Aslan 2004; Ozyurtlu et al. 2008; Zonturlu et al. 2005). Ozyurtlu et al. (2008) reported 75% estrus rates after PRID removal. Also Zonturlu et al. (2005) reported 100% estrus rates in anestrus cows. In this study, estrus rates were found 83.3% in PRID groups and results were similar to the other study groups. After GnRH + PGF<sub>2α</sub> + GnRH protocols estrus rates reported 15.4% by Aral and Colak (2004), 20 % by De Jarnetta et al. (2001) and 78% by Le Blanc et al. (1998). The estrus rates of our study in GnRH + PGF<sub>2α</sub> + GnRH group were found higher than the result of Aral and Colak (2004) and De

Jarnetta et al. (2001) and they were found lower than the results of Le Blanc et al. (1998). Estrus rates were found 68% in our study.

Pregnancy rates were found 60% in this study. Zonturlu et al. (2005) and Ozyurtlu et al. (2008) reported lower pregnancy rates than our results, 14.28% and 33.33%, respectively. In the studies of PRID, pregnancy rates reported between 14.28% and 73% after first inseminations (Kacar and Aslan 2004; Lopez et al. 2001; Penny et al. 2000; Zonturlu et al. 2005). In the group of GnRH + PGF<sub>2α</sub> + GnRH, 37.83% pregnancy rates were reported by Yılmaz et al. (2011). Also pregnancy rates were observed in different rates between 32% and 76.92% in many studies (Pursley et al. 1997; Elibol et al. 2009; Cevik et al. 2010; Aral and Colak 2004; Yılmaz et al. 2011). In our study, pregnancy rates were found 47.05% and it was similar to many results of GnRH + PGF<sub>2α</sub> + GnRH studies.

### 3. CONCLUSIONS

In summary, this study showed the effect of PRID + PGF<sub>2α</sub> + GnRH and GnRH + PGF<sub>2α</sub> + GnRH protocols on estrus rates, timing of estrus and pregnancy rates. It is suggested that both protocols are important approaches in the treatment of postpartum anestrus cows. However, in the comparison of the results of two protocols in the treatment of postpartum anestrus cows, no statistically significant results were found.

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## COMPARATIVE EFFICACY OF ALLOPATHIC, HERBAL, HOMEOPATHIC AND EFFECTIVE MICRO-ORGANISMS FOR THE CONTROL OF HAEMONCHOSIS IN SHEEP & GOATS

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**Key words:** Haemonchosis, Ivermectin, Azedarachta indica, Trematox, EM-Biovet, sheep, goats

### SUMMARY

Haemonchosis caused by *Haemonchus contortus* causes great economic losses in terms of weight loss, poor quality meat and loss of wool in sheep and goats. Therapeutical trials were conducted by using various allopathic, homeopathic, herbal and biological products. For this purpose total of 120 sheep and goats were randomly divided into groups A, B, C, D, E & F and animals in group A, B, C and D were treated with Ivermectin, Azedarachta indica (neem Leaves) Powder, Trematox (a homeopathic drug), EM-Biovet (Effective micro-organisms) respectively. Whereas E and F were kept as infected untreated and uninfected control respectively. Efficacy of drugs was measured based on reduction in EPG count, it was found that ivermectin at recommended dose rate is found more effective; Azedarachta Indica (Neem) found second and Trematox third drug of choice in combating the infection against haemonchosis, whereas EM Biovet was inferior to other drugs. In these studies it was found that Azedarachta Indica (Neem) is cheapest and easily available drug than others. Comparison based on reduction in EPG count indicated that Azedarachta indica and Trematox were fairly affective in combating haemonchosis but EM Bio-vet fail to cure all cases of haemonchosis. It was also noted that all drugs were more affective at two-dose level as compared to one dose level. Ivermectin proved to be best drug against haemonchosis. Efficacy of Azedarachta indica (neem) found to be closer to Ivermectin and EM Bio-vet was inferior as compared to Ivermectin.

The current sheep and goat population of Pakistan are approximately 24.6 and 52.6 million respectively (Anonymous economic survey of Pakistan 2007-08).[1] Despite these large livestock numbers, the economic benefits to their owners remain marginal due to prevailing diseases, poor nutrition, and poor animal production systems. The climatic conditions generally favour the development and survival of the free-living stages of parasites on the pasturelands throughout the year. *Haemonchosis* is a serious health problem which causes lower production due to high morbidity, mortality and cost of treatment and control measures. Vatta *et al.*, (2001); Saddiqi *et al.*, (2010) Disease can be controlled by various means i.e. chemical, biological, and by the use of herbal drugs. Effective microorganisms (EM) also proved to be effective against various diseases. In the past various workers conducted trials by using various herbs i.e.; *Baullinia variegata* (Kachnar fruits), *Butea frandose* (Dhak bark) and *Azedarachta indica* (neem leaves), (Herd *et al.*, 1993; Hammond *et al.*, 1997; Costa *et al.*, 2008)[2,3,4]. Besides all the alternatives available, homeopathy may play a vital role in reducing the pathology in the host. (Cabaret 1996, Hektoen 2005)[5]. Ivermectin is very effective against haemonchosis and is being used in most of the countries of world including Pakistan, Martin, *et al.*, (1997)[6]. It is very costly but easily available where the other i.e. Trematox inj. is an economical and safe. No work has been done on the use of Neem (*Azadirachta indica*),

Trematox inj., and EM-biovet against haemonchosis in sheep and goats. Keeping in view the importance of this disease the study was designed to record the efficacy of various Herbal, Allopathic, Homeopathic and biological products. Effects were also made to record the prevalence of disease in relation to different meteorological factors and also to study the kinetics of the larvae of *Haemonchus*. The data thus obtained was helpful in developing strategy for the control of *haemonchosis* in sheep and goats in Pakistan.

### 1. MATERIAL AND METHOD

- **EXPERIMENTAL ANIMALS:**

A total of 60 sheep kids and 60 caprine kids under two months of age were used. The study was conducted at a private sheep and goat farm.

- **GROUPING OF ANIMALS:**

Ten kids each of sheep and goats were kept as uninfected and untreated control groups A1 & A2 respectively and rest of the kids was infected by oral inoculation with 20000 *Haemonchus contortus* larvae each. The infected kids were divided into groups B1 & B2 (infected control) the groups C1 & C2, D1 & D2, E1 & E2, and F1 & F2 were maintained as test groups (for sheep & goats) respectively. Groups C1 & C2 were administered with ivermectin, Animals in D1 & D2 were given *Azedarachta indica* (neem Leaves), Animals in E1 & E2 were injected with *Trematox*, while animals in group F1 & F2 were given *EM Biovet*.

- **DONOR ANIMALS:**

One sheep and one goat each less than six months of age was purchased from the local market and infected with *Haemonchus contortus* larvae @ 20,000 larvae each. These animals acted as donors for acquiring the eggs used for further research.

- **DRUGS USED**

- Ivermectin (Ivomec, a product of Merial Pharmaceuticals Ltd, France) was given at the rate of 0.2-mg/ kg body weight by subcutaneous route.
- *Azedarachta indica* (neem Leaves) Powder was given at the dosage rate of 100, 200 and 300-mg/ kg body weight orally.
- *Trematox* (a homeopathic drug containing Ferrum phosphoricum and Arsenicum album (Hahnemann, 1996)[3]; manufactured by H. Homeo Pharma Lala Musa Gujrat)-Pakistan was given at the rate of 3, 5 and 7 ml Intramuscular injection per animal.
- *EM-Biovet* (Effective micro-organisms, By EM Technology Nature Farming Research & Development Foundation, Faisalabad). This product was first diluted in drinking water at the rate of 2, 3 and 5 ml per litre and then was given orally for one day of drinking water.

- **EFFICACY OF THE DRUGS:**

Eggs per gram of faeces (EPG) and clinical performance was monitored. Faeces were examined on zero, 7<sup>th</sup> and 18<sup>th</sup> day post treatment. Animals which remained positive on 18<sup>th</sup> day post medication were given a 2<sup>nd</sup> dose of respective drug and faeces were examined on 21<sup>st</sup> and 28<sup>th</sup> day of the first treatment. Efficacy of the drug was calculated as per described formula by Moskey and Harwood, (1941)[7].

$$\text{Per cent Efficacy} = \frac{\text{EPG of faeces before treatment} - \text{EPG of faeces after treatment}}{\text{EPG before treatment}} \times 100$$

**PARASITOLOGICAL TECHNIQUES:**

For the examination of *Haemonchus* ova, larvae and worms, the following techniques were used.

**FAECAL EXAMINATION:****A. Direct Smear Method:**

Pin point amount of faeces were taken on a clean slide and 1-2 drops of water were mixed with it. All the debris was removed. Then a cover slip was placed carefully and slide was examined under microscope for the presence of *Haemonchus* eggs (Zajac *et al.*, 2006)[8].

**B. Mc Master Egg Counting Technique:**

Faecal egg counts were determined by the modified McMaster technique with saturated solution of sodium chloride as the floating medium. In each case, 3 g of faeces were mixed in 42 ml of saturated solution of sodium chloride while the number of *Haemonchus* eggs per g of faeces was obtained by multiplying the total number of eggs counted in the two squares of the counting chambers of the McMaster slide by the dilution factor of 50. *Haemonchus* eggs present were identified using standard parasitological criteria (Soulsby, 1982; Hansen and Perry, 1990 Valderrabano *et al.*, 2001)[9,10,11,12].

**C. Counting Of Worms:**

Following slaughter and evisceration, the entire abomasa of sheep and goats slaughtered at abattoirs during the study period were collected and examined as described by Hansen and Perry (1990)[10]. The abomasa were placed in a plastic container and transported to the laboratory. The entire washings from the abomasa were completely examined individually for worms. The *Haemonchus* present were identified and counted (Soulsby, 1982; Hansen and Perry, 1990; Valderrabano *et al.*, 2001)[10,11,12].

**D) Identification of larval stages (L3)**

Faeces pools were carried out in each group for the coprocultures by the method described by Roberts and O'Sullivan (1952)[13], MAFF, (1986)[14]. The identification of the third stage larvae (L3) was done using the key described by Gruner and Raynaud (1980)[15]; MAFF, (1986)[14]. These samples were cultured to isolate the larvae by Baermann's technique. The larvae were identified and counted using modified method from that described by Martin *et al.*, (1990)[16].

**Statistical analysis.** The data of all groups regarding mortality, morbidity and eggs and larvae count were analyzed by SPSS windows Differences were considered significant at  $p < 0.05$  (Duncan, 1955)[17].

**2. RESULTS AND DISCUSSIONS**

The results of therapeutic trails by using *Azedarchta indica* (Neem), Trematox, EM Biovet and commonly available allopathic drug Ivermectin (Ivomec) are presented in Table 1-6.

Table 1

**Effect of *Azedarchta indica* (Neem) on EPG count in sheep & goats infected with *haemonchosis***

Days post Treatment	Control	Ivermectin	Dose level of mg/kg body weight		
			1 <sup>st</sup> dose		
			100mg	200mg	300mg
0	2520±149.66	2670±130.00	2610±3048.34	2880±120.00	2610±110.00
3 <sup>rd</sup>	2760±132.66	2220±101.98	2310±208.34	2370±113.58	2220±101.98
7 <sup>th</sup>	3030±122.07	1800±77.46	1890±141.77	1740±146.70	1680±111.35
18 <sup>th</sup>	3300±109.55	900±118.32	1410±141.77	1110±110.00	1220±100.00
			2 <sup>nd</sup> dose		
21 <sup>st</sup>	3480±80.00	420±101.98	900±109.54	780±111.36	660±74.83
28 <sup>th</sup>	3630±53.85	90±45.83	420±80.00	420±101.98	270±83.07

Table 2

**Efficacy of *Azedarchta indica* (Neem) against *haemonchosis* in Sheep on different days**

Name of Drugs & dose rate	Efficacy in percentage on different days					
<i>Azedarchta indica</i> (Neem)	EPG on Zero days	EPG on 3 <sup>rd</sup> day	EPG on 7 <sup>th</sup> day	EPG on 18 <sup>th</sup> day	EPG on 21 <sup>st</sup> day	EPG on 28 <sup>th</sup> day
100 mg/kg	2610	11.87	27.58	45.97	65.5	83.90
200 mg/kg	2880	17.70	39.50	61.45	72.91	85.41
300 mg/kg	2610	14.94	35.63	53.25	74.71	89.65

Table 3

**Effect of Trematox on EPG count in sheep & goats infected with *haemonchosis***

Days post Treatment	Control	Ivermectin	Dose level of mg/kg body weight		
			1 <sup>st</sup> dose		
			100mg	200mg	300mg
0	2520±149.66	2670±130.00	2580±142.83	2640±141.78	2910±274.96
3 <sup>rd</sup>	2760±132.66	2220±101.98	2340±172.05	2280±142.83	2550±102.47
7 <sup>th</sup>	3030±122.07	1800±77.46	2040±172.05	1950±136.02	1980±80.00
18 <sup>th</sup>	3300±109.55	900±118.32	1740±172.05	1650±136.02	1530±118.32
			2 <sup>nd</sup> dose		
21 <sup>st</sup>	3480±80.00	420±101.98	1440±172.05	1080±135.65	870±122.07
28 <sup>th</sup>	3630±53.85	90±45.83	870±137.48	570±94.34	480±101.98

Table 4

**Efficacy of Trematox Inj. against *haemonchosis* in Sheep and Goats on different days**

Name of Drugs & dose rate	Efficacy in percentage on different days					
	EPG on Zero day	EPG on 3 <sup>rd</sup> day	EPG on 7 <sup>th</sup> day	EPG on 18 <sup>th</sup> day	EPG on 21 <sup>st</sup> day	EPG on 28 <sup>th</sup> day
Trematox Inj.						
3 ml/sheep	2580	9.30	20.93	32.55	44.18	66.27
5 ml/sheep	2490	8.43	21.68	33.73	56.62	77.10
7 ml/sheep	2910	12.37	31.95	47.42	70.10	83.50

Table 5

**Effect of EM-Biovet on EPG count in sheep & goats infected with *haemonchosis***

Days post Treatment	Control	Ivermectin	Dose level of mg/kg body weight		
			1 <sup>st</sup> dose		
0	2520±149.66	2670±130.00	2310±296.82	2610±179.17	2340±124.90
3 <sup>rd</sup>	2760±132.66	2220±101.98	2340±183.30	2370±170.00	2070±113.59
7 <sup>th</sup>	3030±122.07	1800±77.46	1950±174.64	2010±173.49	1740±116.62
18 <sup>th</sup>	3300±109.55	900±118.32	1680±174.36	1590±161.56	1380±117.19
			2 <sup>nd</sup> dose		
21 <sup>st</sup>	3480±80.00	420±101.98	1290±161.56	1170±175.78	1050±128.45
28 <sup>th</sup>	3630±53.85	90±45.83	810±148.66	600±167.33	540±107.70

Table 6

**Efficacy of EM- Biovet against *haemonchosis* in Sheep and Goats on different days**

Name of Drugs & dose rate	1 <sup>st</sup> treatment				2 <sup>nd</sup> treatment	
	EPG on Zero days	EPG on 3 <sup>rd</sup> day	EPG on 7 <sup>th</sup> day	EPG on 18 <sup>th</sup> day	EPG on 21 <sup>st</sup> day	EPG on 28 <sup>th</sup> day
EM-biovet						
2 ml/litre	2580	9.30	24.41	34.80	50	68.60
3 ml/litre	2610	9.19	22.98	39.08	55.17	77.01
5 ml/litre	2340	11.53	25.64	41.02	55.12	76.92

Table 7

**Efficacy of Ivermectin against *haemonchosis* in Sheep on different days**

Drug & dose rate Ivermectin 0.2 mg/kg body weight	Efficacy in percentage on different days					
	EPG on Zero days	EPG on 3 <sup>rd</sup> day	EPG on 7 <sup>th</sup> day	EPG on 18 <sup>th</sup> day	EPG on 21 <sup>st</sup> day	EPG on 28 <sup>th</sup> day
	2670	16.85	32.58	66.29	84.26	96.62

Table 8

**Live weight and Weight Gain (Net / % age) in sheep and goats in different groups on different days**

Sampling Time	A Group	B Group	C Group	D Group	E Group	F Group
Live weight at 0 Day	12.5± 2.25	11.5± 1.90	12.3± 1.75	14.8± 2.24	12.4± 2.14	13.2± 2.16
Live weight at 18 <sup>th</sup> Day	14.1± 2.41	12.6± 2.10	14.1± 2.02	16.1± 2.12	13.7± 2.24	14.7± 2.19
Live weight at 28 <sup>th</sup> Day	15.2± 2.33	13.3± 2.09	15± 2.15	16.9± 2.05	14.5± 2.23	15.5± 2.18
Net Weight Gain	2.7	1.5	3	2.3	2.5	2.6
%age weight gain	12.27	6.52	13.33	11.50	10.42	11.06

Group A: Healthy control

Group B: Infected untreated

Group C: Treated with Ivermectin Inj.

Group D: Treated with *Azedarchta indica* (Neem)

Group E: Treated with Trematox Inj.

Group F: Treated with EM-biovet

***Azedarchta indica* (Neem):**

Table 1-2 shows that *Azedarchta indica* (Neem) at dose rate of 100mg, 200mg, and 300mg was effective in reducing 83.90, 85.41 & 89.65% EPG count respectively. The efficacy of all the three doses was comparable and 300-mg/kg dose rate was more effective than other dose levels. But the efficacy of Ivermectin (96.62%) was still better than *Azedarchta indica* (Neem). The anthelmintic activity of *Azedarchta indica* has also been reported previously by Nirmal-Sangwan and Sangwan (1998)[18] Mulla and Tianyun, (1999). In many developing countries around the world, farmers, herders, pastoralists and occasionally veterinary surgeons use plant or plant products to treat cases of parasitism. In traditional societies there seems to be a number of plant remedies deemed suitable for each parasitic disease. The present work proved the anthelmintic action of the plant *Azedarchta indica* in response to the existence of popular reports of such activity in animals Pessoa, (2001); Biswas *et al.*, (2002)[19]. Azadirachtin, a chemical compound extracted from *Azedarchta indica* seeds, inhibited 68% of *Haemonchus contortus* egg hatching. Costa *et al.*, (2008)[20] reported that *Azedarchta indica* (neem) extract was very effective in eliminating the *Haemonchus* infection in sheep.

**TREMATOX INJ.:**

Effect of Trematox on EPG count in *haemonchosis* is given Table 3-4. Trematox at dose rate of 3 ml, 5ml, and 7ml was effective in reducing 66.27, 77.10 & 83.50% EPG count respectively. Table 8-9 shows that the efficacy of Trematox at dose level of 7ml/animal was nearly similar to that of Ivermectin. The mean reduction in the number of *Haemonchus contortus* EPG counts in the Trematox Treated group caused decrease in egg laying and control of *haemonchosis* via increased immune response, (Hektoen, 2005)[21]. Cabaret (1996)[5] reported the role of homeopathy in reducing the pathology

in the host. Trematox Inj. Containing the homeopathic medicines Ferrum phosphoricum and Arsenicum album were selected on the basis of Materia Medica (Hahnemann S. (1996)[3]; Arsenicum album produces rapid prostration, with dark bloody dysentery of putrid odour. Ferrum phosphoricum produces marked prostration together with inflammatory conditions and local congestions and haemorrhagic tendency too, (Vannier, 1987)[22]. The choice of the homeopathic medicines was also based on clinical experience and its success for the control of *Haemonchus contortus* in sheep and goats, (Zacharias *et al.*, 2003)[23]. The homeopathic medicine acts by stimulating the entire body, while the conventional anthelmintics act directly and exclusively on the nematodes. This led to a better recovery from haematopoiesis in the homeopathy group, Zacharias, (2008)[24].

#### **EM-BIOVET:**

Em-biovet at dose rate of 2 ml, 3ml, and 5ml was effective in reducing 68.60, 77.01 & 76.92% EPG count respectively. The efficacy of all the dose levels was comparable and more or less similar. Various workers from all over the world have used EM-Biovet and found to be very effective. Chantsavang *et al.*, (1995)[25] France ; Castro *et al.*, (1996) U.S.A[5].; Anjum, (1998)[26] Pakistan and Rehman *et al.*, (1999)[27] Pakistan; Chantsavang and Watcharadkul, (1999)[28] Thailand; Maqbool, *et al.*, (2000)[29] Pakistan; reported that EM- Biovet was very effective against various ailments of bacterial, viral, fungal and parasitic origin.

#### **IVERMECTIN INJECTION:**

The efficacy at recommended dose level of 0.2-mg/kg body weight Ivermectin was 66.29 per cent effective at one-day level whereas at second dose count it was 96.62 per cent effective against *haemonchosis*, Tables 5-6. These results were compared with each other & with corresponding control group & Ivermectin. Ivermectin is probably one of the most widely used antiparasitic drugs worldwide and its efficacy is well established. Entrocasso *et al.*, (2008). Various workers from different countries reported nearly similar results Baraka, (1994) Martin, *et al.*, (1997)[6].

#### **WEIGHT GAIN:**

The mean weight during the entire experiment was influenced significantly by *haemonchosis* ( $p < 0.05$ ). Also the mean weight for the different treatment groups varied significantly based on the product used for the treatment, ( $p < 0.05$ ). When the mean weight of the experimental animals was analysed for the whole duration of experiment, the Group C, treated with Ivermectin Inj. had the highest mean weight of  $15 \pm 2.15$  kg while Group B, Infected untreated had  $13.3 \pm 2.09$ kg. Average daily weight gain was significantly higher for the Ivermectin treated group than for the other groups, Table-8. In the present study weight gain %age during the experiment was below for the infected group than healthy and treated groups, providing a basis for the conclusion that the lower weight gain was due to the deleterious effects of *Haemonchus contortus*. Average daily weight gain was significantly higher for the Ivermectin treated group than for the other groups. It has been reported that following infection with *haemonchosis* there is usually a 10 % reduction in voluntary feed intake and a 30 % decrease in live weight gain (Kryiazakis *et al.*, (1994)[30]. Makun *et al.*, (2008)[31] reported that the average daily gain and faecal egg count were statistically different from healthy and infected animals.

### 3. CONCLUSIONS

Comparison based on reduction in EPG count indicated that *Azedarchta indica* and Trematox were fairly affective in combating *haemonchosis* but EM Bio-vet fail to cure all cases of *haemonchosis*. It was also noted that all drugs were more affective at two-dose level as compared to one dose level. Ivermectin proved to be best drug against *haemonchosis*. Efficacy of *Azedarchta indica* (neem) found to be closer to Ivermectin and EM Bio-vet was inferior as compared to Ivermectin. Besides the clinical symptoms such as weakness, diarrhoea, anaemia, unthriftiness exhibited by the animals before the commencement of the treatment gradually adopted at the end of trails. And there occurred an overall improvement in general body condition of all treated animals. On the other hand the untreated animals showed a sharp increase in EPG count during the experiment.

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## THE EFFECT OF GENOTYPE AND AGE OF HEN ON HAUGH UNITS OF HENS

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**Key words:** hens, age, Haugh units, hen

### SUMMARY

The aim of this research is to examine the effect of genotype and age on shape index of eggs in period of ten months. As material we used eggs of two light line hybrid of hens Hisex Brown and Shaver 579. The obtained average of measuring Haugh units of egg for Shaver 579 hens was 80.87 and it was somewhat higher in relation to the Haugh units of Hisex Brown (77.47). On the basis of the researches, it was noticed that with the growth of hens Haugh units of an egg was decreasing or in other words younger hens had value of Haugh units above 80, while the eggs of older hens had lower Haugh units. According to this, differences between obtained results for shape index of hens in examined chickens were very small.

Modern poultry farming production provides bigger quantities of highly appreciated products for people's nutrition in very short time and with relatively small investment, such as eggs and chicken meat. Chicken eggs contain about 74% of water and 26% of dry material. An egg is rich resource of high value proteins, fat acids, iron, phosphorus, and vitamins (A, E, K, B and B<sub>12</sub>, D), minerals, while it has small quantities of calcium and vitamin C.

Egg production is nowadays based on exploiting genetic potentials of light and middle weight line hybrids of chickens. However, some authors (*Stolic et al.*, 1994 and *Snezana Bogosavljevic-Boskovic*, 1999) point out that production of eggs in industrial poultry farming that uses line hybrids of chickens for production of consumption eggs depends about 70% on paragenetic factors (conditions of growth and eggs production technology), and only about 30% on genetic (inherited) qualities of hens.

Having all these in mind, the aim of this research was to analyze production results of hens Hisex Brown and Shaver 578 hybrids in conditions production in one of our farms.

### 1. MATERIAL AND METHOD

For examination we used eggs obtained from hens of Hisex Brown and Shaver 579. During the period of laying eggs (44 weeks), in other words in period from 19<sup>th</sup> to

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63<sup>rd</sup> week, we tended to provide equal conditions of accommodations, nutrition and care to all examined hybrids. All chickens were fed by factory mixture for laying hens, and they consumed water and food as they wished.

Once a month, from the both proveniences, on the same day, we took a sample of 30 eggs for examination. For both proveniences, during ten four-week periods we examined the total of 600 eggs. For every egg individually, we examined the Haugh units. It was calculated with the calculator of American Instrument Co, based on measured mass of egg and albumen height. These data of eggs quality were processed for proveniences for every sample (period), as well as for entire period of laying eggs applying modern statistic methods.

Data analysis of this examination was performed by common methods of variation statistics. The importance of the difference testing was done by application of the variant model of analyses which is corresponded to two factorial experiments.

## 2. RESULTS AND DISCUSSIONS

The parameters of average values and variability of the Haugh units of the egg-laying hens of investigated hybrids on the beginning and on the end of the production period are presented in the table 1.

Table 1

**The average values and variability of Haugh units of examined hybrids**

Interval	Haugh units							
	$\bar{x}$		$S_{\bar{x}}$		S		CV	
	Hisex	Shaver	Hisex	Shaver	Hisex	Shaver	Hisex	Shaver
I	93.76	92.12	1.41	1.04	7.724	5.689	8.24	6.18
II	84.48	90.94	0.87	1.34	4.765	7.346	5.64	8.08
III	82.20	85.65	1.32	1.13	7.255	6.191	8.83	7.23
IV	83.74	83.51	1.22	1.37	6.678	7.517	7.97	9.04
V	77.08	77.12	1.63	1.56	8.914	8.523	11.56	11.05
VI	72.93	75.37	1.56	1.96	8.530	10.742	11.70	14.25
VII	72.48	79.91	2.18	1.46	11.921	8.013	16.45	10.03
VIII	68.75	74.29	2.67	2.09	14.637	11.475	21.29	15.45
IX	63.58	70.36	2.89	2.18	15.833	11.925	24.90	16.95
X	75.73	79.41	2.04	1.72	11.171	9.427	14.75	11.87
Total	77.47	80.87**	1.78	1.59	9.743	8.69	12.68	10.74

Obtained results precisely and clearly indicate that chickens of hybrid Shaver 579 had slightly higher Haugh units (80.87) then of Hisex Brown (77.47). Determined differences, from the point of view of average values of Haugh units, were statistically very significant,  $P < 0.01$ .

Also, we can notice that the average Haugh units for both examined proveniences decrease in V, VI, VII, VIII, IX and X examination, in other words it was very unstable.

The greatest value of HU (over 80) both examined proveniences are achieved in I, II, III and IV four-week period of examination.

The average values of coefficients of Haugh units variation were somewhat bigger in Hisex Brown hybrids and it was 12.68. Obtained average values of Haugh units were somewhat higher than results obtained by *Zlatica Pavlovski et al.* (1994), *Hopic et al.* (1995) and *Natasa Tolimir et al.* (1997) somewhat lower than the results reported by *Zlatica Pavlovski*, (1986).

According to recorded data, it can be seen that with increasing of hens growth number of Haugh units is decreased and highest values of both genotypes are recorded in first laying period while smallest in ninth period. It confirm known rule that albumen quality is decreased with hens growth. Examined data are in agree with data of *Nair* (1985), *Hopic et al.* (1995) and *Natasa Tolimir et al.* (1999).

The shape and strength of absolute and relative dependence between effects of growth and Haugh units of chicken eggs is shown in the table 2.

Table 2

**Effect of growth on Haugh units**

Hybrid	Functions	Regression coefficients	Correlation ( $r_{xy}$ )
Shaver 579	Linear	$\hat{y} = 99,74609 - 0,496786x$	-0,842**
	Quadrat	$\hat{y} = 128,2104 - 2,14563x + 0,021695x^2$	0,921**
	Exponential	$\hat{y} = 101,4571 \cdot e^{-0,00606x}$	-0,837**
	Logarithmic	$\hat{y} = 147,0269 - 18,44089 \ln x$	-0,882**
	Cobb-Douglas'	$\hat{y} = 180,1533x^{-0,22423}$	-0,874**
Hisex Brown	Linear	$\hat{y} = 101,291 - 0,6268208x$	-0,865**
	Quadrat	$\hat{y} = 130,3087 - 2,30773x + 0,022117x^2$	0,918**
	Exponential	$\hat{y} = 104,4699e^{-0,008019x}$	-0,859**
	Logarithmic	$\hat{y} = 160,0755 - 23,02472 \ln x$	-0,896**
	Cobb-Douglas'	$\hat{y} = 220,2332x^{-0,29282}$	-0,885**

On the basis of the Table 2, we can clearly see that the square type of function most accurately presents the shape of dependents between the growth and Haugh units of eggs in examined proveniences. Defined coefficients of correlation show strong and statistically very significant correlation in for both examined proveniences ( $r= 0.921^{**}$  Shaver 579 and  $r=0.918^{**}$  Hisex).

### 3. CONCLUSIONS

With the purpose of comparative examination of eggs quality and of light line hybrids of chickens, we carried out the experiment which lasted from 19. to 63. week of age. The examination included two hybrids of hens Shaver 572 and Hisex Brown.

On the basis of obtained data we can make conclusion that during the whole period of examination chickens Shaver had higher Haugh units, except from in I and IV period of examination. Calculated difference in significance of average values of Haugh units in examined hybrids was statistically very significant,  $P < 0.01$ . High significance was found in age factor as well, so the eggs of young chickens of examined hybrids had more oval shape.

Generally, both of hybrids gave satisfying results when speaking of eggs quality. Besides that, the most adjusted line of regression between age and eggs Haugh units was square function and it was very significant.

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## **RESEARCHES CONCERNING THE REPRODUCTION ACTIVITY ANALYZE IN A DAIRY FARM SUPPLYING PLOIESTI AREA**

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**Key-words:** dairy farm, reproduction activity, reproduction indices

### **SUMMARY**

Nowadays, dairy cows become more and more the modern production ways which have to be improved directly the quantity, quality and efficaciousness of the obtained yield. The problem of increasing the animal livestock, a better prolificacy and breed structure improvement are great objective of specialists in the field. Reproduction management in dairy cows have to be achieved step by step during the whole year within the intensive rearing system. The artificial insemination is the most efficient bio technique in animal breeding and its success influences directly and also important the profit of the cattle breeders.

That is why, the present paper proposes itself to study the reproduction activity in a dairy farm, with a great importance in milk supplying within a large area with great milk consumers.

### **1. MATERIAL AND METHOD**

The reproduction activity of cattle livestock to milk and meat yield increasing is made by artificial insemination spreading with tested bulls and natural service using for only authorized bulls [1,4].

In the present paper we obtained the main indices which represent the reproduction ability in bovine. To achieve the proposed objectives the studies were made in a Montbeliarde breed rearing unit where there were taken into consideration the primary evidences to calculate the following reproduction indices:

- » fecundity
- » age at first calving
- » length of pregnancy
- » calving interval
- » service-period
- » dry period
- » milk yield

The studied livestock consisted in 100 Montbeliarde cows, during two lactations. The primary data were recorded and there were calculated the main statistic indicators of the population.

## 2. RESULTS AND DISCUSSIONS

The fecundity represents the percentage ratio between the total number of females diagnosed as pregnant and the total females' number inseminated after many heat cycles. The values of this index vary depending on age category, between 85-90%. Pregnancy percentage at first insemination is 55-60%. The value of the fecundity index calculated in the farm is 76%. The fecundity index at the second pregnancy is 87%, using 1,88 mean doses of semen. To obtain a high percentage of fecundity at the second pregnancy the artificial insemination would have done in the optimum moment [1,5].

The length of pregnancy in cows is almost 9,5 months, that means almost 285 days, but this interval depends on the maintaining system, age, health and animal breeding range. In table number 1 it is analyzed the length of pregnancy on 100 cows livestock during two pregnancies. The length of the first pregnancy in the studied farm was 279,90 days, with a low individual variability, the mean error was 1,49, the standard deviation was 14,79 and the variability coefficient was 5,28%. At the second pregnancy, the length of it was almost 283,88 days, it was noticed a normal variability as 3,31%, the mean error was 0,95 and the standard deviation 9,42.

The average on the two pregnancies is 281,89 days, so it may conclude that there were not recorded difficulties.

*Table 1*

**The length of pregnancy**

No.	Mean +/-	Error	Standard deviation	Variability coefficient
Pregnancy 1	279,90 +/-	1,49	14,79	5,28
Pregnancy 2	283,88 +/-	0,95	9,42	3,31
Mean	281,89 +/-	1,22	12,10	4,29

Calving interval is an indicator expressed in days, which calculates in adult females the interval between two calving. The length of it depends upon the size of the service period and the length of pregnancy. In table no 3 it is presented the mean length of calving interval. In the studied unit, the mean value of this index is framed between 406,35 days and 387,61 days, these values exceeded the optimum value [4,5]. The individual variability of this feature was a little emphasized, with standard deviation values between 44,49 and 51,78 and the variability coefficient between 10,94 and 13,35%, as is seen in table number 2.

*Table 2*

**Calvin interval values**

No.	Mean +/-	Error	Standard deviation	Variability coefficient
Pregnancy 1	406,35 +/-	5,07	44,49	10,94
Pregnancy 2	387,31 +/-	5,90	51,78	13,35
Mean	396,83 +/-	5,48	48,13	12,14

Service-period represents the interval between calving and the new pregnancy installation. It has the optimum value of 80 days [3, 5]. Following the recorded data it may notice that the values in the studied farm exceeded the optimum values in a normal unit. Depending on pregnancy the values vary between 123,77 days and 102,9 days, with a large variability, 37,33%. This exceeding determined significant economic losses by a low number of calves and milk yield and also supplementary feeding expenses.

Table 3

**The length of service period**

No.	Mean +/-	Error	Standard deviation	Variability coefficient
Pregnancy 1	123,77 +/-	5,23	51,77	41,82
Pregnancy 2	102,59 +/-	3,40	33,71	32,85
Mean	113,18 +/-	4,31	42.74	37.33

The dry period is not considered a reproduction index but the importance of this period is a technologic and economic one. Generally, the length of this period is almost 60 days, but it is established for each cow, taking into consideration its age, the productive level, the length of previous lactation, health and the season the period is in. Based on the primary data, in the present study, the length of the dry period varies between 60,28 days and 54,06 days, with a mean value of 57,17 days and a variability coefficient of 38,81% [1,4].

Table 4

**The length of dry period**

No.	Mean +/-	Error	Standard deviation	Variability coefficient
Pregnancy 1	60,28 +/-	2,41	13,62	22,59
Pregnancy 2	54,06 +/-	5,26	29,75	55,03
Mean	57.17 +/-	3.83	21,68	38,81

The milk yield in the studied farm recorded 6851,47 kg in the first lactation and 7161, 82 kg in the second one, that shows a good productive precocity. The individual variability was high, with a mean value of 30,25% as is shown in table 5. Analyzing the milk quality it was recorded 4% fat and 3,5% protein.

Table 5

**The milk yield**

No.	Mean +/-	Error	Standard deviation	Variability coefficient
Lactation 1	6851.47 +/-	585.11	2545.25	37.14
Lactation 2	7161.84 +/-	401.34	1745	24.37
Mean	7006.65 +/-	493.22	2145.12	30.25

The age at the first calving is an indicator with direct effects upon dairy cows rearing; it influences directly the efficacy of this activity. The breeder is interested that

the age at first calving be low, but not related to the future productions. The first mating was at 897,79 days, but with a large variability, the standard deviation was 127,7 and v% was 14,27 [2,5].

### 3. CONCLUSIONS

- The analyzed population proved a good fecundity, with a 76% value in the first pregnancy and an increasing at the second one to 87%, using 1,9 doses of sperm.
- The length of the first pregnancy was 279,9 days, and the second one of 283,3%. The mean value 281,9 days proved that the analyzed livestock has no reproductive disorders.
- First calving interval was 406,35 days, but decreased at the second interval to 387,61 days.
- Service-period presented higher values in a normal exploiting unit, for both pregnancies.
- Dry period decreased during the analyzed interval from 60,28 days to 54,06days.
- The milk yield increased at the second lactations from 6851,47 kg to 7161,82 kg, with individual performances of 11063 kg at the second lactation.
- Following the analyze, we may conclude that the reproduction activity in the studied unit is framed into the breed and species standard but it is recommended a more supervised activity to females in heat to decrease the calving interval.

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## FACTORS AFFECTING DAYS OPEN IN BULGARIAN MURRAH BUFFALO COWS

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**Key words:** buffaloes, days open, linear analysis, factors, seasonality

### SUMMARY

5742 Bulgarian Murrah buffalo cows, bred on seven national farms in the period 1980–2009, were assigned with the objective to study the specific effects of different factors and combination of factors on days open. The data were processed using the software products LSMLMW and MIXMDL (Harvey, 1990), the linear models including the random effect of sire (1...99), the fixed effects of farm (1...7), month of calving (1...12), period of calving (1...6), parity (1...2), age at first calving (1...7), the regression with 305-day milk yield (MDL-1), and the interactions of month with farm (MDL-2) and parity (MDL-3). Largest variation in the trait days open was established to be caused by the factor parity ( $F=363.71$ ). The effects of month ( $F=21.31$ ) and its interactions with farm and parity have shown to be highly significant, days open being shortest after calving in the main season (May to August). Seasonality at first calving was observed to be more pronounced and different from that at second-plus – peaks in April-June and July-August respectively. Farm and period of calving have also affected days open – at high and low degree of significance respectively.

Besides on the improvement of the productivity traits and on their heritability, genetic gain in a herd is strongly dependant on generation interval, which relatively long and variable in the buffalo. As the economic weights indicate (Peeva, 2000), in the selection programmes concerning the national population of buffaloes special attention should be focused on the period from calving to conception.

Regardless of the type of breeding adopted – artificial insemination or natural-service – there are many non-genetic factors affecting female buffalo reproduction (Alexiev et al., 1987; Peeva et al., 1988; Shah et al., 1989; Aziz et al., 2001; Hassan et al., 2007; Khan M.S. et al., 2009; Marai et al., 2009). Part of them is connected with farm management including those concerning reproduction, like efficiency of oestrus detection and application of artificial insemination or libido of the bulls selected. Another also great portion of variation in days open is due to the typical environmental effects of year (period) and season, with essential contribution of the latter.

Seasonality of calving is among the peculiarities of reproduction distinguishing the bubaline species. Although specific for the different conditions in the different parts of the world and in the different breeds, there is marked seasonality in conception and respectively in calving in the calendar year (Qureshi et al., 1999; Züge et al., 2004; Di Francesco, 2010). Regardless of the causes – being of endocrinal or genetic origin (Rao and Pandey, 1982; Qureshi et al., 1999; Carcangiu et al., 2011) – conception in buffalo cows should occur in due time after calving in view of the risk of entering in a undesirable seasonal anoestrus (Paraschivescu et al., 2007), leading to a prolonged generation interval in perspective.

On national scale there are also studies on the matter, the majority of calvings being concentrated in spring and summer. These reports also concern days open in conventional statistics (Alexiev et al., 1988; Peeva et al., 1988) and the effect on calving interval (Penchev, 1999; Peeva, 2000) but not the specific effect of season (or month) on the variance of the subsequent days open.

The present investigation was initiated with the objective to study the specific effect of different factors and combination of factors on days open for a comparatively long period of the time of development of the Bulgarian Murrah breed of buffaloes.

### 1. MATERIAL AND METHOD

The study assigned 5742 Bulgarian Murrah buffalo cows, having calved on seven national farms within the period 1980–2009.

The data were processed using the software products LSMLMW and MIXMDL (Harvey, 1990). To study the different effects on days open, were constructed four mixed models (Least-Squares и Maximum Likelihood) with the following sources of variance:

- Model 1 (MDL-1) including the random effect of sire (1...99) and the fixed effects of farm (1...7), month of calving (1...12), period of calving (1...6), parity (1...2), age at first calving (1...7), and the regression with 305-day milk yield.
- Model 2 (MDL-2) including the interaction between farm and month of calving.
- Model 3 (MDL-3) with the interaction between parity and month of calving.

### 2. RESULTS AND DISCUSSIONS

The analysis of variance (Table 1) shows that of all effects on days open most pronounced is that of parity ( $F= 363.71$ ,  $P< 0.001$ ). As the data indicate, month of calving is also a highly significant source of variation ( $F= 21.31$ ,  $P< 0.001$ ), as well as the interaction of month with parity ( $F= 28.34$ ,  $P< 0.001$ ) and farm ( $F= 5.27$ ,  $P< 0.001$ ) – all three defining seasonality in reproductive efficiency.

Days open is also strongly affected by farm ( $P< 0.001$ ), while the effect of period has a significance of low degree ( $P< 0.05$ ). These results suggest that the reconstruction periods of the national agricultural economy have influenced the buffalo reproduction within the population as a whole and in different way in the separate herds. They are in keeping with many authors' observations that reproduction traits, days open (calving interval) in particular, are dependant mostly on farming conditions, breeding management, climate and resources and to a minor extent on genetic lineage (Alexiev et al., 1987; Peeva et al., 1988; Shah et al., 1989; Aziz et al., 2001; Hassan et al., 2007; Khan M.S. et al., 2009; Marai et al., 2009). It is also in correspondence with the low values of the coefficient of heritability resulted from the present (Table 1) and the above mentioned studies.

The results in Table 2 indicate that days open after first calving is by a month and a half longer than that after second and more ( $P< 0.001$ ). The longer time needed to rebreed after first service is rather normal (Boikovski, 1977; Alexiev et al., 1987; Penchev, 1999;

Peeva, 2000) due to the higher stress in young animals caused by growth, first calving, and first lactation (Bashir, 2006; Khan M.S. et al., 2009).

The table shows that for all records assigned in the study greatest is the concentration of calvings in the spring-summer season, in accordance with other earlier results concerning the Bulgarian Murrah (Alexiev et al., 1988; Penchev, 1999; Peeva, 2000). Nevertheless, as Figure 1 shows, there is difference in season of calving between the primiparous and pluriparous buffaloes. There is better pronounced seasonality at first calving, the peak being in May and the percentage of calvings in the period September-February – very low. The later calvings (second and more) have more uniform distribution year round, the peak being in July-August. Though not very well elucidated, the mechanisms of seasonality are explained with the fluctuations in gonadal functionality and hence in progesterone concentrations due to different environmental conditions (Rao and Pandey, 1982; De Rensis and Scaramuzzi, 2006), regardless of the phase of uterine involution (Qureshi et al., 1999); as well as with the concentrations of melatonin and the genetic sensitiveness towards them (Parmeggiani et al., 1994; Carcangiu et al., 2011). Likewise, the differences in seasonality of reproduction between primiparous and pluriparous buffaloes could be attributed to different functional activity of the breeding apparatus and of the epiphysis, as well as to different susceptibility to environmental changes (stress factors), in regard to oestrus manifestation and conception rates.

As apparent from Table 2, the buffaloes that calve from April to October have by 16.3 to 38.7 d significantly shorter days open compared with those in the other part of the year. This is better pronounced again in the young animals, where the calvings from late autumn to late spring – being relatively fewer, as was pointed out – result in longer period needed to rebreed (Figure 2). Remarkable is the substantial increase from a days open of 140.3 d in October calvers to 194.8 d in November, which suggests very small portion of conceptions from April to May. In the adult buffaloes the shortest days open belongs also to those calving from April to October with the distinction that the differences among the calendar months are smaller – in the range from 91.5 to 132.0 d. Our results are in correspondence with the established on national scale longer days open and calving interval in the winter- and spring-calving buffaloes (Peeva et al., 1988; Penchev, 1999).

As a function of the percentage of calvings in the separate calendar months and the corresponding value of the trait days open (all-parity records in consideration, Table 2) is presented the expected distribution of post service conceptions (Figure 3). In contrast to calvings distribution (given for comparison) the distribution of the conceptions is considerably more uneven year round. Noteworthy is the low percentage of post-calving conceptions during the first half of the year, and especially the markedly very small portion from February to May. Hence, that conceptions distribution suggests a presumably same seasonality of calving in the following year.

To sum up, it should be noticed that an in-season freshening buffalo (spring and summer) needs less time to rebreed, which is most probably due to the good supply with quality meal and roughage, the favourable climate with still long photoperiod, and the high libido of males (if natural service is practiced) in autumn when conception is to occur; an expression of the essential role of environmental effects on days open. But it

also should be borne in mind that reproduction is also to a great extent management dependant and that failure to rebreed in due time brings that buffalo cow into a seasonal anoestrus (Paraschivescu et al, 2007), when in addition bulls are reluctant to mate and heat detection is problematic (when AI applied), which penalizes the reproductive efficiency in the farm.

Table 1

Analysis of variance ( $h^2 = 0.102$ )

Sources of variance	Model	df	F	
<i>Factors:</i>				
Sire	MDL-1	98	1.97	***
Farm	MDL-1	6	3.85	***
Month of calving	MDL-1	11	21.31	***
Period	MDL-1	5	2.29	*
Parity	MDL-1	1	363.71	***
Age at first calving	MDL-1	6	1.00	n.s.
<i>Regressions:</i>				
305-day milk yield	MDL-1	1	114.44	***
<i>Interactions:</i>				
Farm x Month	MDL-2	83	5.27	***
Parity x Month	MDL-3	23	28.34	***

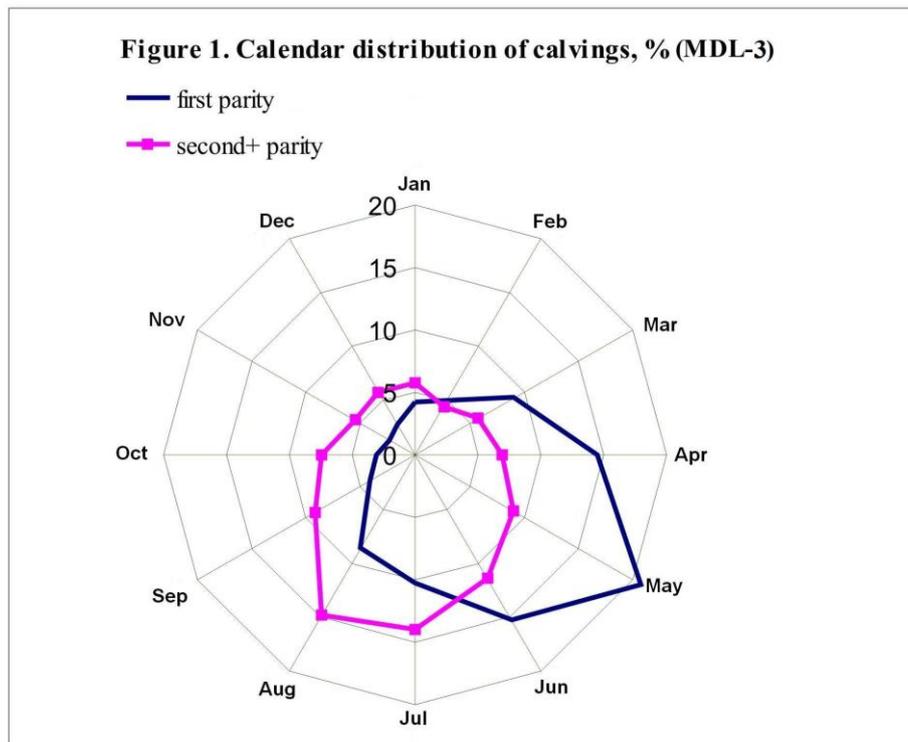
Table 2

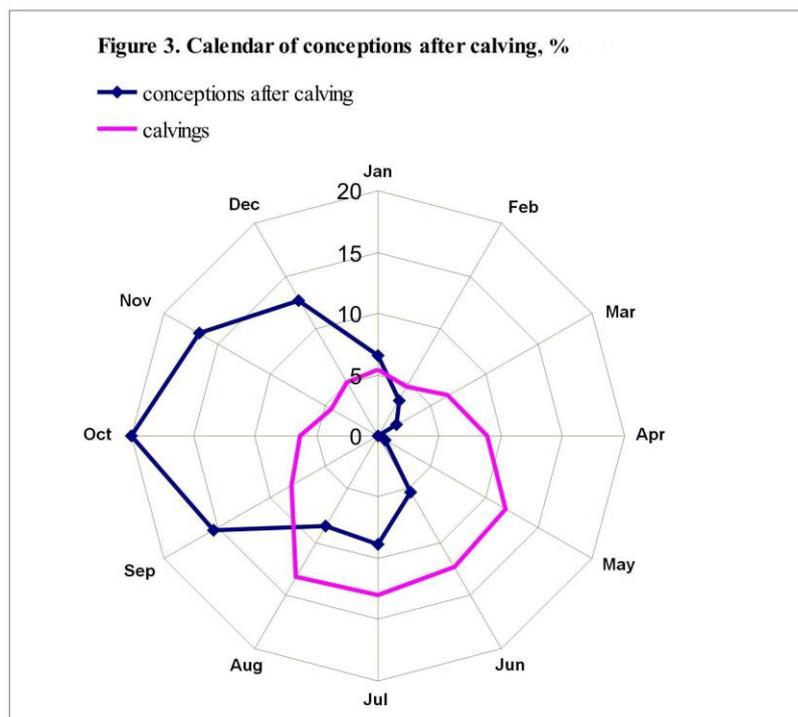
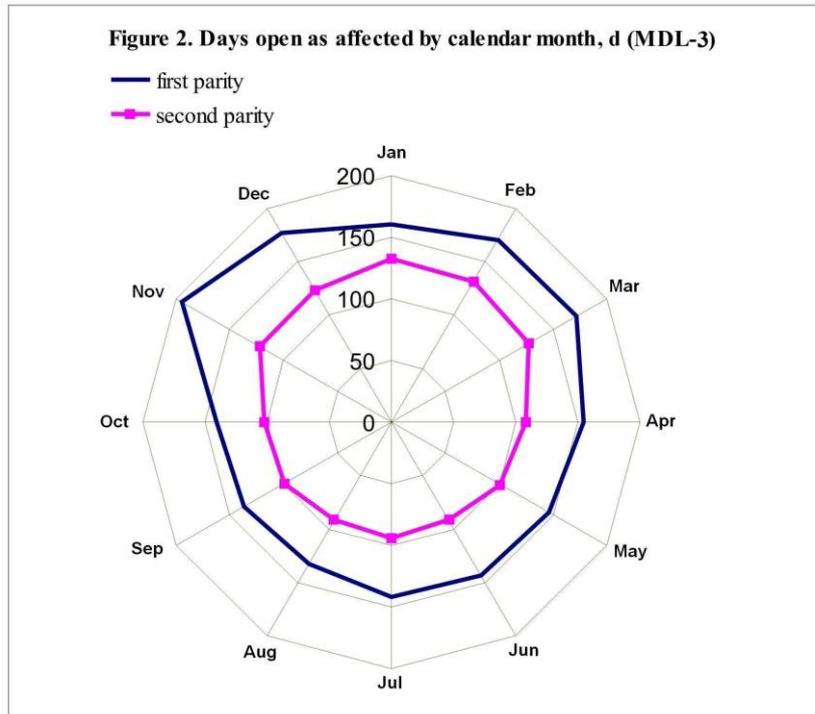
## Effect of parity and month of calving (MDL-1)

Season	n	%	LSM $\pm$ SE	Td
<i>Parity</i>				
First	1412		155.9 $\pm$ 4.19	(2)***
Second	4330		110.2 $\pm$ 3.83	
<i>Calendar month</i>				
January	309	5.4	151.6 $\pm$ 5.36	(4 $\div$ 10)***
February	266	4.6	152.8 $\pm$ 5.56	(4 $\div$ 10)***
March	381	6.6	150.5 $\pm$ 5.07	(4 $\div$ 10)***
April	504	8.8	131.0 $\pm$ 4.79	(8)** (6;7;11;12)*
May	681	11.9	123.4 $\pm$ 4.53	(11)*** (12)**
June	709	12.4	116.4 $\pm$ 4.49	(11;12)***
July	749	13.0	117.0 $\pm$ 4.49	(10)* (11;12)***

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August	760	13.2	114.1 ± 4.45	(11;12)***
September	458	8.0	120.4 ± 4.89	(11;12)***
October	363	6.3	124.0 ± 5.15	(11;12)**
November	272	4.7	148.1 ± 5.59	
December	290	5.1	147.3 ± 5.49	
Overall LS-mean	5742	100.0	133.1 ± 3.84	





### 3. CONCLUSIONS

Largest variation in the trait days open in the Bulgarian Murrah buffaloes was established to be caused by the factor parity ( $F= 363.71$ ).

The effects of month ( $F= 21.31$ ) and its interactions with farm and parity have shown to be highly significant, days open being shortest after calving in the main season (May to August).

Seasonality at first calving was observed to be more pronounced and different from that at second-plus – peaks in April-June and July-August respectively.

Farm and period of calving have also affected days open – at high and low degree of significance respectively.

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## THE DIGESTIVE UTILIZATION OF IRON AND COPPER IN THE SWINE GROWING ORGANISM

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**Key words:** swine growing, iron, copper, radioactivity.

### SUMMARY

The aim of this study was to evaluate the evolution of the contained of iron and copper in blood, liver, fat, muscles, in the conditions in which iron and copper marked with radioactive isotope  $^{56}\text{Fe}$  and  $^{64}\text{Cu}$  have been used. The established values obtained experimentally demonstrates an accumulation of radioactive iron and copper bigger than in liver and muscle, the resulted microelements after digestion passing through the mucous membrane of the small intestine, from where by porta vein are transported to the liver and from here by the general blood circulation reaching at the level of tissue and cells. Also, the two mineral elements have a better action when they are used together in pigs alimentation, than when they are used alone.

In the pig organism mineral substances can have a plastical effect (passive, being a part of some tissues) and/or a functial effect (active, being a part of nutritive substances metabolism, in maintaining the osmotical preasure, cellular permeability, in the acido-basic equilibre, in the neuro-muscular excitability and being a part of some enzymes, hormones, vitamins or other essential compounds – e.g. haemoglobin) (Drăgotoiu D., 2003).

The plastic effect and the physical-chemical functions belong mostly to macroelements, for which bigger requests appear.(Church D.C., 1996).

Oligoelements mostly have an active effect (metabolical and physiological), in the group of aditives because of the proportions of use, moreover because of the determinated efects (Dinu I., 2002).

### 1. MATERIAL AND METHOD

The researches have been made on the number of 21 pigs from the LS-345 Peris Synthetical Line, being divided in 3 batches uniformly by body weight (25,3 kg) and the ratio between sexes (table 1).

The swine nutrition from all the 3 batches has been realised with the same compound feed, with the recipe 0-3 in the first phase (tabel 2), the differences being in the proportion of microelements from vitamino-mineral premix utilised. The experimental batch no. 1 received the vitamino-mineral premix, in which got added the iron sulphate and copper sulphate, containing radioactive isotope  $^{56}\text{Fe}$  and  $^{64}\text{Cu}$ . The experimental batch no. 2 received a premix in which iron sulphate was used, and batch no.3 got a premix in which the copper sulphate was introduced.

Table 1

**The experimental scheme**

Specification	Batch		
	E1	E2	E3
Swine number (heads)	7	7	7
Experimental period (days)	28	8	28
Iron sulphate	1,64	-	1,64
Copper sulphate	0,32	0,32	-

Table 2

**The structure and the parameters of the compound feeds used in experiment**

Specification	Phase I
Maize	67,00
Barley	8,30
Soya meal	11,00
Pea	7,00
Fish meal I	1,50
Yeast	2,40
L-lysine	0,15
DL-methionine	0,06
Choline premix	0,10
Calcium carbonate	0,69
Dicalcium phosphate	0,80
Salt	0,50
Vitamins-mineral premix	0,50
<b>TOTAL</b>	100,00
<b>The recipes parameters</b>	
ME (kcal/kg)	3155
PB (%)	15,21
Lysine (%)	0,67
Methionine+cistine (%)	0,43
Methionine (%)	0,28
Triptofan (%)	0,14
Treonine (%)	0,57
Calcium (%)	0,79
Phosphorus (%)	0,45
Brute cellulose (%)	3,09

From the each batches were sacrificed two animals at 8, 16 and 28 days to establish the way of repartition of marked iron and copper in pigs' organism. The radioactivity of iron and copper marked with the  $^{56}\text{Fe}$  and  $^{64}\text{Cu}$  isotope from the samples of blood, liver, intestine, muscles have been measured with the spectrometer with liquid scintillation Beckman LS-6500.

The main observed targets in the experiment have been the evolution of bioproductive parameters, the obtained results at the slaughtering and the evolution of the contained of iron and copper in blood, liver, fat, muscles, in the conditions in which iron and copper marked with radioactive isotope  $^{56}\text{Fe}$  and  $^{64}\text{Cu}$  have been used.

The experimental dates have been statistical expounded, using the Student test.

## 2. RESULTS AND DISCUSSIONS

The influence of the microelements levels administrated to the swine at fattening over the bioproductive performances unregistered by them during the whole experimental period is presented in the table 3.

Table 3

**The bioproductive performances of swine registered in the experimental period**

Batch	Average daily gain (g/head/day)	Average daily consumption (kg/head/day)	Specific consumption (kg compound feed/kg gain)
E1	598 $\pm$ 8,73	1,95 $\pm$ 0,08	3,26 $\pm$ 0,99
E2	575 $\pm$ 10,25	1,87 $\pm$ 0,11	3,25 $\pm$ 1,03
E3	564 $\pm$ 9,16	1,83 $\pm$ 0,21	3,24 $\pm$ 1,00

From the analyses of the obtained results it can be observed that the experimental batch no. 1 has registered a biggest daily gain (598 g/head/day) during the whole experimental period, the experimental batches having an decrease of daily gain (3,8-5,7%). It has been observed that the deficiency of copper from the premix has been much more felt.

The daily consumption of the compound feed varied between 1,83-1,95 kg/head/day at the experimental batches and the specific consumption has been the same at the three batches (3,24-3,26 kg compound feed/kg gain).

The results obtained after slaughter are presented in table 4. The slaughter randament between 76,25% at the E3 batch and 77,57% at the E1 batch, which received the complete addition of microelements, the differences being significant.

Table 4

**The results obtained at the slaughter**

Batch	Slaughtering randament (%)	Average thickness of fat (cm)	Meat in carcass (%)
E1	77,57 $\pm$ 0,61	1,96 $\pm$ 0,17	57,3 $\pm$ 0,29
E2	77,17 $\pm$ 0,79	2,43 $\pm$ 0,29	53,1 $\pm$ 0,21
E3	76,25 $\pm$ 0,54	2,31 $\pm$ 0,35	54,5 $\pm$ 0,36

The meat proportion from the carcass has been bigger at the swine from the batch where have been administrated the two microelements. The supply administration of microelements, indifferent of the premix type, determined a smaller deposit of fat tissue.

The swine from batch E received the complete mixture of microelements, presented the carcasses with the smallest proportion of fat.

For looking after the way of repartition of iron and copper in the pigs' organism after the ingest of the marked microelements has been measured the evolution of the iron and copper radioactivity from blood, liver, fat and muscles (tables 5 and 6).

Table 5

**The evolution of the total radioactivity of iron in pigs' organism (DPM/g) ( $\times 10^3$ )**

Batch	Sacrifice at:	DL-methionine in:			
		blood	liver	fat	muscle
E1	8 days	123,86 $\pm$ 1,37	247,37 $\pm$ 4,18	123,66 $\pm$ 1,82	212,97 $\pm$ 4,46
	16 days	158,12 $\pm$ 2,64	328,46 $\pm$ 7,52	147,56 $\pm$ 3,00	292,69 $\pm$ 7,94
	28 days	206,72 $\pm$ 6,35	409,98 $\pm$ 11,16	235,51 $\pm$ 4,62	363,63 $\pm$ 8,16
E3	8 days	97,43 $\pm$ 2,12	237,17 $\pm$ 5,46	112,37 $\pm$ 2,18	210,32 $\pm$ 4,63
	16 days	115,09 $\pm$ 2,74	317,37 $\pm$ 7,19	122,46 $\pm$ 3,52	262,18 $\pm$ 7,26
	28 days	176,64 $\pm$ 4,04	363,17 $\pm$ 9,27	199,28 $\pm$ 3,84	304,15 $\pm$ 6,84

Table 6

**The evolution of the total radioactivity of copper in pigs' organism (DPM/g) ( $\times 10^3$ )**

Batch	Sacrifice at:	DL-methionine in:			
		blood	liver	fat	muscle
E1	8 days	99,05 $\pm$ 1,97	127,16 $\pm$ 3,37	106,87 $\pm$ 1,33	131,33 $\pm$ 2,99
	16 days	133,67 $\pm$ 2,61	141,53 $\pm$ 2,91	120,74 $\pm$ 1,51	148,79 $\pm$ 3,35
	28 days	187,59 $\pm$ 4,03	180,39 $\pm$ 3,79	132,07 $\pm$ 3,23	179,54 $\pm$ 4,01
E2	8 days	92,27 $\pm$ 1,17	119,42 $\pm$ 2,65	99,79 $\pm$ 1,93	128,38 $\pm$ 3,27
	16 days	114,26 $\pm$ 1,63	129,67 $\pm$ 2,29	105,11 $\pm$ 2,28	132,28 $\pm$ 2,84
	28 days	146,87 $\pm$ 2,08	167,12 $\pm$ 3,02	125,50 $\pm$ 2,47	159,53 $\pm$ 3,34

At the experimental batches 1, which has been administrated two sources of microelements, respectively iron sulphate and copper sulphate, it has been established a progressive increase of iron and copper radioactivity, in the experimental period in blood, liver, fat and muscle.

Regarding the evolution of iron radioactivity in the pigs' organism, bigger values have been registered at the end of the experimental period at the first batch with 409,98 DPM/g in liver and with 363,63 DPM/g in muscle, comparative to the samples from blood and fat (206,72 DPM/g and 235,51 DPM/ml).

During the experimental period it has been measured the iron radioactivity from the organism pigs from experimental batch no. 3, established an decrease of radioactivity determined because of a small diminution of food consumption.

A higher values of the radioactivity of copper has been determined in blood (187,59 DPM/ml), liver (180,39 DPM/ml) and in muscle (179,54 DPM/ml). The lower value was observed in fat (132,07 DPM/ml).

At the second experimental batch, at which the copper sulphate has only been used, lower values of radioactivity have been observed at all the analyzed samples, comparing to the batch at which the iron sulphate and copper sulphate have been used.

Progressive developments of radioactivity of copper has been observed at the liver, where at the end of the experience value of 167,12 DPM/g have been established, being bigger in comparison with the samples from blood and fat.

The established values obtained experimentally demonstrates an accumulation of radioactive iron and copper bigger than in liver and muscle, the resulted microelements after digestion passing through the mucous membrane of the small intestine, from where by porta vein are transported to the liver and from here by the general blood circulation reaching at the level of tissue and cells. Also, the two mineral elements have a better action when they are used together in pigs alimentation, than when they are used alone.

Being a part of haemoglobin (effect in oxygen and carbon dioxide transport), mioglobin (from muscles), some enzymes (effect in metabolism), the iron builds reserves (ferritin, hemosiderin, transferrin), its' absorption being influenced by the presence of copper, but also zinc, manganese, cadmium (Pichon A., 2000).

Copper is a compound of some enzymes, being a part of collagen, erythrocytes, having an effect of a pig growing biostimulator (Stoica I., 2011).

### 3. CONCLUSIONS

1. The measured values of the radioactivity of iron and copper marked with the isotope  $^{56}\text{Fe}$  and  $^{64}\text{Cu}$  indicates that in the organism is deposited the iron and copper in bigger quantities in muscle and liver.

2. The two mineral elements – iron and copper - have a better action when they are used together in pigs alimentation, than when they are used alone in mineral premix.

3. The obtained results at the slaughtering have been positively influenced by the supply of microelements, a significant effect having over the average fat thickness and the meat proportion from the carcass.

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**ROMANIAN PRESENT SITUATION AND PERSPECTIVES OF POULTRY  
MEAT PRODUCTION AND CONSUMPTION IN EUROPEAN AND  
INTERNATIONAL CONTEXT**

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**Key words:** poultry, meat, production, consumption

**SUMMARY**

Romanian poultry production chain is similar to those in the other European countries but in Romania the chain is shorter than in other European countries meaning that poultry producer is also integrated in processing chain and so live broiler supply of processing chain is assured. This makes poultry producers position stronger in the product chain by shortening road between production and consumer plate.

We are going to present you the situation of poultry meat production in Romania during last 20 years and perspectives until 2020.

Globalization is revolutionizing agriculture during last years. Due to demand for processed and highly processed products more and more companies are changing their supply sources or they are even relocating themselves in world zones with lower broiler production expenses. Areas with higher broiler production expenses, as Europe or Japan, are losing the battle with countries with lower labor and feed costs like Brazil or Thailand which are keeping their export volumes permanently on the increase.

At the same time humanity has to face the need for higher food safety standards. Last decade food scares (EBS, Salmonella enteritidis, E. coli 157, dioxins) made food safety increase the number 1 priority of consumers in rich countries which are demanding highest standards of food safety.

Poultry industry is characterized by a clear interdependence of production chain from primary breeding to processing. Theoretically this should be an advantage for food safety comparative with activities which are not integrated and in which separate companies are responsible for different stages of production (incubation, feed mills, slaughterhouses, etc.). Obviously processing companies which are looking for poultry meat supply from third sources are renouncing to their direct control over most production chain. Supply from long distances needs a particularly robust quality assurance system and it should be possible for this system to be efficiently inspected and controlled.

Today European poultry production is organized around a limited number of processors which are integrating poultry production by poultry complexes for most European production. The two main entities (producers – processors) are linked by very strong contractual relationship which is closer than in other agricultural sectors. To face competition poultry meat production is striving for reducing costs for product unit. This cost shortening leads to a limited ability to make investments and so to a concentration of production and processing.

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processing chain is assured. This makes poultry producers position stronger in the product chain by shortening road between production and consumer plate.

We are going to present you the situation of poultry meat production in Romania during last 20 years and perspectives until 2020.

Live poultry meat production (Table 1) dropped with 108 thousands tons (41.1%) in 2000 compared to 1990 but in 2010 live poultry meat production increased with 143 thousands tons (54.3%) compared to 1990 and with 251 thousands tons (161.9%) compared to 2000. In 2020 poultry meat production is expected to reach 664 thousands tons or 258 thousands tons higher than in 2010 (63.5%).

Table 1

### Poultry meat production

	- 000' tons -			
	1990	2000	2010	2020
Live poultry (industrial production)	263	155	406	664
Poultry for slaughtering	205	121	317	518
Poultry meat for export	2	4,7	63,49	100
Poultry meat for domestic market	203	116,3	253,5	418

*Sources: UCPR, INS*

Poultry meat products offer for the internal market (Table 2) in 2010 was 25% whole poultry, 30% cuts and 45% giblets.

Table 2

### Poultry meat for domestic market 2010

	000' tons	%
Whole poultry	79,3	25
Cuts	95,1	30
Giblets	142,6	45
TOTAL	317	100

*Sources: UCPR*

Projections for total live poultry meat for 2020, (Table 3) are showing an increase of total production to 664 thousands tons from which 620 thousands tons broiler meat and the rest other species. Turkey meat production is expected to increase in 2020 to 21 thousands tons or 3.1% of whole live production.

Table 3

### The future (2020)

	000' tons
Live poultry (total)	664
Poultry for slaughtering from this: - chicken	620
- spent hen	16
- turkey	21
- goose	2
- duck	5
Export	128
Domestic poultry for meat consumption	536

*Sources: Romanian Poultry Industry Development Strategy – 2011*

Poultry meat production for processed products (Table 4) increased in 2010 over anterior periods with 158% compared to 1990 and with 192% compared to 2000 respectively. For 2020 it is forecasted an increase to 121 thousands tons or 128% more compared to 2010.

Table 4

**Further processed products****- Tons -**

	<b>Total</b>	<b>Domestic</b>	<b>Exports</b>
<b>1990</b>	<b>20 500</b>	<b>18 500</b>	<b>2 000</b>
<b>2000</b>	<b>18 150</b>	<b>14 297</b>	<b>3 853</b>
<b>2010</b>	<b>53 000</b>	<b>48 126</b>	<b>4 874</b>
<b>2020</b>	<b>121 000</b>	<b>84 700</b>	<b>36 300</b>

*Sources: UCPR*

Export of poultry meat and poultry meat processed products (Table 5) increased with 51,540 tons in 2010 compared to 2000. Most poultry meat for export went to EU Member States (88.42%) and the rest of 11.5% in other countries of the world.

Table 5

**Export for different regions****- Tons -**

	<b>2000</b>	<b>%</b>	<b>2010</b>	<b>%</b>
<b>EU</b>	<b>4 600</b>	<b>98,31</b>	<b>56 140</b>	<b>88,42</b>
<b>Russian Fed.</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Rest of Europe</b>	<b>16</b>	<b>0,34</b>	<b>48</b>	<b>0,08</b>
<b>Rest of World</b>	<b>63</b>	<b>1,35</b>	<b>7 300</b>	<b>11,5</b>
<b>TOTAL</b>	<b>4 679</b>	<b>100,0</b>	<b>63 490</b>	<b>100,0</b>

*Sources: UCPR, Romanian Poultry Industry Development Strategy – 2011*

Need of live broilers for processing (Table 6) will increase to 280 million heads in 2020 representing 51.3% more compared to 2010. Need of breeding females (Table 7) will be 2500 thousands hens, 25 thousands turkeys, 30 thousands geese, 25 thousands.

Table 6

**Day old poultry for domestic market****- 000's -**

	<b>2010</b>	<b>2020</b>
<b>Broiler</b>	<b>185 000</b>	<b>280 000</b>
<b>Turkey</b>	<b>140</b>	<b>1 500</b>
<b>Goose</b>	<b>-</b>	<b>500</b>
<b>Duck</b>	<b>-</b>	<b>1 700</b>

*Sources: UCPR, Romanian Poultry Industry Development Strategy – 2011*

Table 7

**Parent stock (female)  
2020**

	- 000's -
	<b>2020</b>
<b>Broiler</b>	<b>2 500</b>
<b>Turkey</b>	<b>25</b>
<b>Goose</b>	<b>30</b>
<b>Duck</b>	<b>25</b>

*Sources: UCPR, Romanian Poultry Industry Development Strategy – 2011*

**World's poultry meat production trend**

World's poultry meat production increased from about 91.1 million tons in 2008 to 91.9 million tons in 2009 and estimations for 2010 were 94.2 million tons compared to about 106 million tons pig meat and less than 65 million tons beef meat.

The halt of poultry meat production in 2010 was the first sign of the slowdown observed in this sector in last period. Projections for 2010 were higher but production was obstructed by worries about feed costs at the middle of the year when grain prices showed signs of considerable rising.

In table 8 you may see how close regional volumes are reproducing the general halt of poultry meat production compared to 2008 and 2009. The global increase with 2.5% is shown again uniformly distributed between regions.

Table 8

**World poultry meat production by region (mil. tons)**

<b>Region</b>	<b>2000</b>	<b>2005</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
Asia - Pacific	23.9	28.7	32.6	33.1	34.0
North America	17.5	20.3	21.4	20.6	20.9
Latin America	12.1	15.6	19.0	19.1	19.8
Europe	11.9	13.1	14.4	15.4	15.8
Africa	3.0	3.5	3.7	3.7	3.7
World's poultry meat production	68.4	81.2	91.1	91.9	94.2

Source: Watt Executive Guide 2010

According to OECD/FAO projection we should expect an annual average increase of world poultry meat consumption of nearly 2 kg/person until 2019 from 13.5 kg la 15.3 kg which is going to increase the necessary amount with 26 million tons. The same projection are also indicating that in 2007-2009 91 million tons poultry meat have been produced yearly and this production might increase to nearly 118 million tons until 2019. Details are shown in table 9.

Table 9

**Forecasts for world poultry meat to 2019**

<b>Specification</b>	<b>2005</b>	<b>2010</b>	<b>2015</b>	<b>2019</b>
Production (million tons)	83.23	95.03	107.56	117.85
Export (million tons)	8.54	10.27	11.79	13.17
Import (million tons)	8.01	9.33	10.36	11.38
Total consumption (million tons)	82.69	94.05	106.13	116.05
Consumption by inhabitant (kg)	12.72	13.64	14.56	15.3

Source: Organization for Economical Cooperation and Development (OECD) 2010, Watt Executive Guide

**These are the challenges for European poultry industry:**

**Raw material markets volatility.** First challenge is production costs and first of production costs is also feed cost. Worldwide rise of raw material costs directly hit production costs in which and feed cost is 65% of whole production costs. Present level of payments for poultry producers for their products is unable to cover production costs of poultry producers considering also the rising course of the other inputs (gases, electrical power, environmental costs, animal welfare costs, etc.).

**Poultry producers have to differentiate themselves.** As custom taxes for EU imports are decreasing due to multilateral agreements for liberalization agricultural trade inside World Trade Organization or bilateral agreements for liberalization with MERCOSUR member countries poultry products imports can only increase and competition will be harsh for European poultry production difficult to support by European poultry producers. Preference for European poultry meat produced in average size farms should be maintained and if possible extended to "play" the role of "proximity differentiation": high quality products, with high added value, produced with energy sparing, respecting the environment, respecting the animal welfare rules (highly demanding about health safety) and linked to a traditional production more attached to territory.

**Increasing pressure on poultry producer's revenue.** Farmers have little power to negotiate contracts and they are receiving just a small amount from added value created by production chain. There should be created mechanisms for stopping power abuses in chain food and avoiding price obtained by animal producer to decrease.

**International policy and eggs and poultry meat production standards for different applied in Europe which is higher compared to imports from third countries.** If there would be a gradual liberalization of agricultural products trading, because drawbacks of applying stipulations of Doha round of the World Trade Organization, European farmers would have to deal on home market with import products which are not complying with same rules about food safety, animal welfare and environment protection. So competitiveness of European farmers will decrease with no advantages at all for European citizens or for rural areas in EU.

**Specific proposals about PAC after 2013.**

How should European poultry industry face identified challenges?

***Making markets more functional and more stable.*** On short term this is about a more active dissipation of cost rising in the food chain. For this purpose poultry industry should be united and it should make common cause and it should be organized around producer's organizations, cooperative societies or professional organizations. On long term this is about organizing the supply with raw materials at reasonable prices and limiting prices volatility on these markets.

***Keeping instruments for market management for poultry industries products distribution.*** It is of utmost importance to avoid diminishing communitarian protection by treaties with third countries and to keep restitutions for exports otherwise EU would become a net importer of poultry meat as it happened in 2007.

***Consolidation of poultry producers inside production chain.*** For being able to cover their production costs poultry producers are asking a more fair payment for their production from poultry slaughtering and processing companies. Creating a law environment allowing contractual agreements on voluntary base (by poultry producers' organizations) might help poultry producers to improve their control on final price performed by major retail outlets (hypermarkets). The newcomer short channels meaning a shortcut between production and consumer's "plate" is a new element which could strengthen poultry producers' position inside product chain. The new PAC should contain flexible and innovative measures which should be able to make possible a stronger position of poultry producers during negotiations and for poultry producers to get themselves nearer to opportunity of directly producing processed foods. European poultry industry is looking for a short and closed road.

***Public policies renewal.*** European international commercial policy and European agricultural policy should be integrated and they should reward measures for environment protection, animal welfare and health safety which are all guaranteed by the European poultry producers. European poultry industry should remain competitive on a more and more globalized market. Cost of European demands should be supported by consumers or compensated by diverse forms of support (competitiveness, compensating costs increase due to applying European legislation, etc) or applying an assurance system to guarantee a minimum agricultural income for poultry producers.

***Research and development.*** Efforts for a more environmentally friendly animal production system in a broad way should include especially the animal welfare which seems to be a necessity. Research and development should be mobilized to obtain a more economical production system, with lower fossil energy quantities which should find raw materials necessary to feed animals not competing with those used in human food. There should be selected valuable animals which are using better raw materials not used or a little used. Animal manure amounts should be reduced as much as possible and there should be found means to use them by using their potential for fertilizing as reduction of quantities of mineral fertilizers is another target of poultry producers for the future. Poultry producers should assume their responsibility in assuring a maximum health safety

and research has an important role here: profound pathogenesis knowledge, ways of transmitting knowledge and the answer of animals and reduction of chemical and biological contaminations and creating fast and efficient methods for detecting chemical and biological contaminations etc. All these are requesting coordinated efforts of different operators in the following areas: research, research-development, production, processing and distribution.

**Quality and labeling.** Clear labeling of the country of origin and the way of preparing poultry meat and marking the base products produces from poultry meat should become mandatory and the obligation should be enforced by European legislation. Labeling should allow an easy identification of imported product and their country of origin and it should allow especially finding infringements about high production standards found at European level. The ways of applying standards for poultry meat marketing should be re-assessed in the future. Poultry producer's target is to assure a higher transparency of products offered to consumers and to clarify problems about product marketed with the term "fresh".

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## **OBTAINING THE NECESSARY LIVING FOOD FOR REARING THE TURBOT (*Psetta maxima maeotica*) IN ITS EARLY LIFE STAGES**

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**Key words:** turbot, living food, aquaculture

### **SUMMARY**

Ensuring the food necessary for a planet that becomes over-populated remains a major challenge in the third millennium, although humanity confronts with vital problems, incurable diseases, accidental pollutions. Aquaculture can be an alternative and an infinite food source, while also giving a chance to endangered species conservation, by compensating the losses due to overfishing and supplying 20% of the consumable aquatic products at global scale.

The turbot (*Psetta maxima maeotica*) is a demersal species that populates the Romanian Black Sea's continental shelf and is an important segment of the regional aquaculture potential under the aspect of market demand, both on the national and international level. The paper hereby presents some aspects concerning the aquaculture of green algae, rotifers and *Artemia*, very important living food products that are successfully used in the Black Sea turbot rearing, in its first stages of development.

### **1. MATERIAL AND METHOD**

The paper hereby is based on the consultation of an abundant bibliographic material, as well as on the results of the research and experiences carried out within NIMRD between 1980 and 2011. The experiments were recently reproduced, using new technologies and sources of biological material. Unlike tens of years before, we used pure algal strains purchased from laboratories in U.S.A. For starting the rotifer cultures we used resting eggs, purchased also from U.S.A. We used the experimental base of the Institute, comprising both exterior concrete basins and laboratories, equipped with all the necessary facilities.

### **2. RESULTS AND DISCUSSIONS**

In Romania, the ecological state of the Black Sea and the diminished fish catches produced catastrophic changes in the natural exploitable resources productivity. Today, the marine aquaculture is a relatively recent field of activity, which started to develop scientifically, both for economical and ecological reasons.

Aquatic organisms are easily affected by environmental conditions. Their maximum sensibility manifests during ontogenesis and metamorphosis. The chance to survive and develop normally depends a lot on the quality and naturalness of the ingested food. Through its composition, the “living food” essentially contributes at covering the entire necessities specific for fish larvae, concerning the composition in proteins, lipids, glucose, vitamins, oligo-elements, hormones and enzymes, ensuring the energetic support in living, growing and development.

## ALGAL CULTURES

Within turbot reproduction, the phytoplankton comprise anyone or all the following functions: (a) food for the rotifers, (b) enriches the nutritive value of the rotifers and *Artemia*, (c) detoxifies the water in which the turbot larvae are raised, by assimilating or neutralizing the toxic substances such as ammonia and pesticides. The growing model has five phases: the moderate growing, the fast growing, the slowing of growing, the stationary and the collapse one. At the beginning of the experiment, pure strains of *Nannochloropsis* sp. and *Tetraselmis* sp. were purchased from a specialized laboratory in U.S.A., in sealed plastic recipients.

Stock culture. In this small scale culture phase, the stock culture is maintained in test-tubes in laboratory. A separate room is used, in order to avoid contamination with rotifers or other algae. The stocking room for the algae must be sterilized weekly. The room must have air conditioner, for keeping the temperature between 18 - 22°C, the proper temperature for the algae. The photoperiod is controlled to 12 hours light – 12 hours dark, by using fluorescent lamps. In this stage, the glass test-tubes and recipients are recommended.

The sea water is filtered through fiberglass filters and kept in recipients for a few months before use. The “old” water is put in culture recipients and sterilized.



Photos 1 and 2: Stock cultures of *Nannochloropsis* sp. and *Tetraselmis* sp. kept in controlled environment

Test-tubes culture. Two stock culture drops must be inoculated in every one of the 20 test-tubes used at this phase, by using sterilized pipettes. The test tubes contain 10 ml of nutritive culturing solution. A clean, uncontaminated stock culture is recognized by its transparency. Also, a uniformity of the cell dimensions, observed at the microscope, is a good indicator. The cultures are let to grow for two – three weeks, and after that they can be transferred in bigger recipients. The test-tubes must be daily agitated, for preventing the accumulation of the cells at the bottom.

5 l culture. The recipients must have air evacuation tubes and cotton wool plugs. A strong aeration (6 l/min.) must be ensured for homogenizing the culture. A single uncontaminated test-tube is inoculated in a 5 l recipient, together with 3.5 l of nutritive

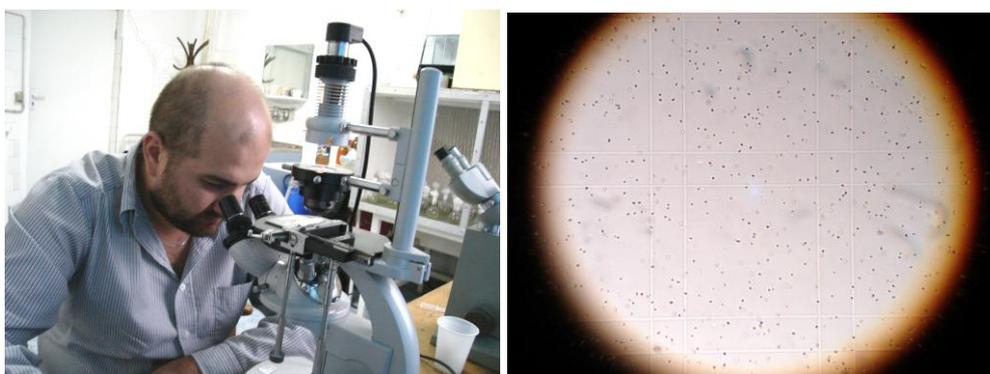
solution. The density for *Nannochloropsis* sp. is of  $80 - 100 \times 10^6$  cells/ml at 4 – 7 days after inoculation.

100 l culture. Transparent polycarbonate tanks will be filled with water and chlorinated with 300 ppm liquid chlorine for one night before using. In the morning, the water will be neutralized with sodium thiosulphate for a few minutes. The aeration must be adjusted to 8 l/min. Agricultural fertilizers will be added into tanks, and the 5 l starter culture will be added also. The density will reach  $40 \times 10^6$  cells/ml in one week. Now, the cultivated algae will be used as living food for rotifers.



Photos 3 and 4: 5 and 100 l cultures of *Nannochloropsis* sp. and *Tetraselmis* sp. obtained in controlled environment

Cell counting. The density of each culture should be daily recorded. The counting of algal cells is made by using an inverted microscope and a hemacytometer.



Photos 5 and 6: Inverted microscope and hemacytometer counting detail

Measures for avoiding contamination. Visual inspection of tanks will be made daily and microscopic observations also. If green balloons at water surface or dirt on tank walls exist, a rotifer contamination can be suspected. A sample should be analyzed at the

microscope. If rotifers will be found, chlorine solution at 15 ppm will be added in the tank for 30 minutes and then it will be neutralized. Because rotifer eggs might survive this treatment, the procedure will be redone the next day.

#### ROTIFER CULTURES

This is a small group of aquatic invertebrate organisms, comprising about 2000 species. In turbot breeding it is essential to use rotifers as living food for the early life stages, because of the mouth dimensions. *Brachionus plicatilis* is the most cultivated.

Small scale culture: at the beginning of the experiment, *B. plicatilis* was purchased from a specialized laboratory in U.S.A. as resting eggs, 1000 – 3000 per each sealed glass recipient. The eggs were placed in sterilized marine water, and in about 48 hours they began to hatch.



Photos 7 and 8: Rotifer resting eggs, delivered in sealed glass recipients, and their filling with sea water for hatching

200 ml culture. Before putting the freshly hatched rotifers from one recipient in the 200 ml Erlenmeyer glass, 20 ml of fresh *Tetraselmis* sp. culture will be placed in. The algal density will be adjusted to  $2 \cdot 10^6$  cells/ml. After one week, rotifer density will be 150 rotifers/ml. One part will be transferred into test tubes for stock culture, and other will be inoculated in bigger recipients as following.

5 l culture. The rotifers from the 200 ml recipient will be poured in the 5 l one, by tilting the smaller recipient. The rotifers will be fed with 200 ml fresh *Tetraselmis* sp. culture. Every two days, 350 ml of algal culture will be added to ensure food, until the culture volume reaches 4 l (about 150 rotifers/ml). Aeration is still not necessary.

Mass culture. There are two standard cultivation systems. In “mixed – culture” system, rotifers in the tank will be totally harvested and a part of them will serve for inoculating other tanks. In “exploitation – culture” system, rotifers are only partially harvested, and the volume difference in the tank will be filled with algal culture.



Photos 9 and 10: 5 liter and mass culture of rotifer *Brachionus plicatilis*

Rotifer counting. Samples from tanks will be analyzed at stereomicroscope to determine the density. A drop of Lugol solution is used for killing the organisms. The number of ovigerous rotifers will be divided to the total number, for obtaining the fertility rate. A culture having a fertility rate below 10% has regeneration problems.



Photos 11 and 12: Counting the rotifer *B. plicatilis* at stereomicroscope

Harvesting. The drainage valve will be opened and the rotifers will be retained in a net having the mesh eye of 80  $\mu\text{m}$ . During harvesting, we must avoid the collision of rotifers with air bubbles, because it causes a high mortality.

#### ARTEMIA NAUPLII

In turbot cultures, *Artemia* sp. nauplii are the second living food, which follows the rotifer diet. In our experiments, *Artemia* sp. eggs were purchased from specialized stores, and they began to hatch at 24 hours from their placement in marine water.

Cylindrical tanks are filled with sea water and aerated. The eggs are placed in these tanks, in a concentration of 1 g/l. They are put to hatch for 22 hours, with strong aeration.

Before harvesting, the aeration is stopped and the tank is let for 10 minutes, so the eggs that have not hatched to depose at the bottom. Then, the hatched ones will be harvest using a net with the mesh eye of 114  $\mu\text{m}$ , and rinsed with salt water.



Photos 13 – 15: Cultivation of *Artemia* sp. (photos made by L. Alexandrov)

### 3. CONCLUSIONS

The turbot is an important segment of the national marine aquaculture potential under the aspect of market demand. Its chance to survive and develop normally in aquaculture farms depends on the quality and naturalness of the ingested food. Through its composition, the “living food” essentially contributes at covering the fish larvae necessities, by its composition in proteins, lipids, glucose, vitamins, oligo-elements, hormones and enzymes.

In the past few years we used pure algal strains bought from specialized laboratories in U.S.A and rotifer starter-kits, bought also from U.S.A. The experiments showed that using this kind of sources for the biological material is valid, the food chain (phytoplankton – zooplankton – turbot larvae) being well reproduced within our experimental base.

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## IDENTIFICATION OF DIFFERENT BACTERIAL AGENTS IN PORCINE LUNG TISSUE

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**Key words:** pig, lung, bacteria

### SUMMARY

Respiratory disease belongs to the most important problems in intensive pig production worldwide. Economical losses are expressed through direct losses due to death, stunted growth with increased feed conversion, massive need of antibiotic treatment of infected herds and a decrease in meat quality. Various causes of respiratory disease have been identified, including viruses, bacteria and parasites. Secondary bacterial infection of lung tissue already compromised by primary pathogens frequently occurs.

The main purpose of this survey was to investigate presence of different respiratory bacterial pathogens in porcine lung tissue. The investigations covered a total of 184 pathoanatomically altered lung tissue of dead pigs. The samples were examined in a laboratory for the presence of bacterial causes using standard and commercial methods of microbiological diagnostics.

The samples were inoculated on corresponding culture media (blood agar, MacConkey agar, Columbia agar). For the primary isolation of *Actinobacillus pleuropneumoniae* and *Haemophilus parasuis*, agar with 5-10% sheep's blood was used and the culture of the strain *Staphylococcus aureus* as a source of NAD. Suspicious colonies were subcultivated on chocolate agar with PolyVitek (bioMerieux). Once an organism has been isolated, the identification was made using morphological, cultural characteristics and biochemical activity. The identification was confirmed using the BBL Crystal E/N, G/P ID Kit (Becton Dickinson).

From the total of 184 examined lung samples, bacteria strains were isolated from 145 samples (78,80%). A total of 9 different bacterial species were identified. Two bacteria strains were dominant among the spectrum of lung microorganisms: *Pasteurella multocida* (*P. multocida*) 31,03 %, and *Actinobacillus pleuropneumoniae* (*A. pleuropneumoniae*) 24,14%.

The participation of the other 7 bacterial species ranged from 0,69-14,49 %.

Infection with mixed bacteria was established in 16 (11,03 %) lung samples. The presence *Pasteurella multocida* and/or *Actinobacillus pleuropneumoniae* was established in each of the 16 cases of mixed infection. The high prevalence (78,80 %) of identified bacteria from pig lung indicated their importance in ethio-pathogenesis of the pig respiratory infections.

### 1. MATERIAL AND METHOD

The objective of the investigations described in this paper was to carry out the identification and to establish the incidence of certain strains of bacteria that take part in the etiopathogenesis of pig respiratory infections. The investigations covered a total of 184 pathoanatomically altered lungs of expired pigs. Sampling was done during visits to pig farms, most often in situations when it had been necessary to resolve occurring respiratory infections.

For this purpose, the samples of pig lungs with pneumonic lesions were inoculated on nutrient agar supplemented with 5 per cent defibrinated sheep blood, Columbia and MacConkey agar (HiMedia) and incubated aerobically at 37°C for 18-24 h.

Bacterial isolates were identified using standard methods for phenotypic characterization as previously described (Holt et al., 1994, Quinn et al., 2002). The identification was confirmed using the BBL Crystal E/N, GP, ID Kit (Becton Dickinson), Api 20 Strep, Slidex Staph Plus (bioMerieux).

For the isolation of *Actinobacillus pleuropneumoniae* and *Haemophilus parasuis*, additional blood agar plates with a *Staphylococcus aureus* streak as a source of the NAD, were incubated in jar with reduced oxygen and enhanced carbon dioxide content.

Suspicious colonies were subcultivated on chocolate agar with PolyVitex (bioMerieux) and were identified on the basis of morphological and biochemical characteristics.

## 2. RESULTS AND DISCUSSIONS

From the total of 184 examined lung samples, bacteria strains were isolated from 145 samples (78,80%). A total of 9 different bacterial species were identified (Table 1). Two bacteria strains were dominant among the spectrum of lung microorganisms: *P. multocida* 31,03 % and *A. pleuropneumoniae* 24,14%. The prevalence of infection with *A. pleuropneumoniae* was lower than in our previous studies (Žutić et al., 2009).

The participation of the other 7 bacterial species ranged from 0,69-14,49 %.

Infection with mixed bacteria was established in 16 (11,03 %) lung samples. The presence *Pasteurella multocida* and/or *Actinobacillus pleuropneumoniae* was established in each of the 16 cases of mixed infection. The high prevalence (78,80 %) of identified bacteria from pig lung indicated their importance in ethio-pathogenesis of the pig respiratory infections.

Table 1

### Results of bacteriological investigations of pig lungs

Species bacteria	No. isolates	% isolates
<i>Pasteurella multocida</i>	45	31,03
<i>A. pleuropneumoniae</i>	35	24,14
<i>Haemophilus parasuis</i>	21	14,49
<i>Streptococcus</i> spp	18	12,41
<i>Arcanobacterium pyogenes</i>	3	2,07
<i>Actinobacillus suis</i>	3	2,07
<i>Streptococcus suis</i>	2	1,37
<i>Bordetella bronchiseptica</i>	1	0,69
<i>Staphylococcus aureus</i>	1	0,69
Mixed infection	16	11,03
Total	145	100,00

The most significant problems in contemporary pig production are in connection with diseases of the respiratory system. In modern swine systems respiratory disease has evolved to more of a Porcine respiratory Disease Complex –PRDC (Baker 2005). This term is frequently used in lay and scientific text today. Some of the more common viral components include porcine reproductive and respiratory syndrome virus (PRRS), swine influenza virus (SIV), porcine circovirus type 2 (PCV2), porcine respiratory corona virus (PRCV) (Yamamoto, 2001, Ivetić et al., 2005, Bochev 2007). The list of bacterial infections involved in PRDC are *Mycoplasma hyopneumoniae*, *P. Multocida*, *A. pleuropneumoniae*, *Streptococcus* spp, *Haemophilus parasuis*, *A. suis* etc. (Battrell 2000, Žutić Jadranka et al., 2008, Faur et al., 2010).

It is a characteristic of the current manner of production to set up agglomerations with concentrations of large numbers of animals within a small space. Such conditions are especially favourable for respiratory pathogens and suit the continued maintaining of a high degree of their virulence in vivo (Woeste and Grosse, 2007, Žutić et al., 2008).

As a result, there are increasingly frequent outbreaks of respiratory infections which are more difficult to control, with the maintenance conditions in large agglomerations exerting an extremely unfavorable effect (Holko et al., 2004). This is further enhanced by the fact that farms in Serbia rarely carry out the procedure of giving the object a rest (Žutić et al., 2009), which would enable minimal exposure to the endemically present pathogens and consequently lead to the development and equalizing of the immune status of all animals in the group (Gemus, 1996).

The majority of authors draw the general conclusion that the prevalence of respiratory diseases always increases when the number of live agents in the environment is increased, or when the reaction of the defense mechanism of the respiratory system is weakened for some reason (Papatsiros et al., 2007, Tizard, 2009).

The viruses PRRS and PCV2, or even both viruses, were detected in all farms from which samples were collected for bacteriological examinations in our investigations, and their individual or joint effect had as the ultimate result an extremely local (in the lungs) but also system-related immunosuppression which is considered one of the main factors that contributes to the increase of bacterial exacerbation of lethal acute pneumonias.

It has been established that, following the appearance of the viruses PRRS and PCV2, the bacterial isolates often differ among animals within one production category, or between different production categories on one farm (Bruguera et al., 2006). The explanation for this lies primarily in the different capability of animals to react to antigens, and in the unequal immunological status of the herd being a consequence of the immunosuppressive effects of these viruses, on the one side, and also the evolutionary course and speedy changes in the generations of bacterial species and their adapting to the new environmental conditions, on the other.

### 3. CONCLUSIONS

The presence of other, primarily viral pathogens (PRRS and PCV2) and *M. hyopneumoniae*, which individually, or much more frequently as synergisms,

significantly hinder the reactivity of the organism and begin incipient changes in lung tissue by facilitating the invasion of bacterial pathogens, considerably contributes to the significant participation of respiratory pathogen bacteria in the etiology of pneumonic lesions detected in animals from the examined farms.

It is important to point out, for the purpose of diagnostics and the control programme, that the interaction of pathogens is very complex and that each one of them causes, either individually, in synergism or as competition, a certain manifestation of PRDC. All of this renders the control of respiratory infections very complex, and often even impossible to solve.

The control of respiratory disease requires an understanding of the complexities and interaction between the organisms that are present, the pig and the management of the environment. The prevalence of respiratory disease is affected by the presence of respiratory pathogenic organisms, the virulence of the pathogens present, the level of the pathogens in the house environment, the immunity of the pig, the presence of secondary bacteria, and the interactions between management, environment, the diseases and the pig.

Based on the obtained results, we are of the opinion that it is very important to identify the participation of individual pathogens in the etiopathogenesis of respiratory infections in pigs, primarily in order to view an existing infection, but also in order to be able to undertake measures and programmes for the implementation of therapy and prevention. With this goal in mind, large numbers of experts all over the world today devote great attention to optimising health measures and programmes for the production of healthy animals and their products, which at the same time ensures the protection of human health.

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## **SEROPREVALENCE OF MYCOPLASMA HYOPNEUMONIAE IN SOWS FROM 6 FARMS IN SERBIA**

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**Key words:** Mycoplasma hyopneumoniae, sow, antibodies, iELISA.

### **SUMMARY**

Mycoplasma hyopneumoniae (M.hyopneumoniae) is the causative agent of mycoplasmal pneumonia (MP), a chronic respiratory disease in pigs with high morbidity and low mortality. M.hyopneumoniae also contributes to the porcine respiratory disease complex (PRDC). PRDC is a common pneumonia in pigs caused by infection with multiple pathogens. Both disease conditions cause major economic losses to the swine industry mainly due to reduced growth, poor feed conversion, increased medication costs and increased mortality.

That is why we determined the following as the objectives of our work; Investigations of sows blood sera for the presence of antibodies against M. hyopneumoniae, using the iELISA test. For the investigations, samples were taken of the blood of 1204 sows originating from 6 swine farms. Investigations were carried out using the method of indirect ELISA with the following diagnostic kits: HerdChek M.hyo:Mycoplasma hyopneumoniae, antib. test Kit.

Antibodies against M.hyopneumoniae were established in 470 ( 39.03%) sera of sows. The percentage of positive sera differed among the farms, ranging from 0,0-67,77%. The results of the investigations have shown that infection with M. hyopneumoniae is present in sows on 5, from 6 examined farms. The successful control of M. hyopneumoniae depends on the efficient prevention of the transfer of the infective agent, both between the farms and also between certain categories of animals on the same farm. Good results can be achieved using the strict implementation of reliable serological methods. The serological control of sows and gilts is of particular importance, so that infected animals could be detected prior to fertilization animals that should be eliminated from the herd because of the known fact that mothers transfer the infection to their offspring at birth. Also, technological conditions on the farms have an important role in the spread of mycoplasmal pneumonia.

### **1. MATERIAL AND METHOD**

For the investigations, samples were taken of the blood of 1204 sows originating from 6 swine farms. Investigations were carried out using the method of indirect ELISA with the following diagnostic kits: HerdChek M.hyo:Mycoplasma hyopneumoniae, antibody test Kit.

### **2. RESULTS AND DISCUSSIONS**

The aim of the study was investigations of swine blood sera for the presence of antibodies against M. hyopneumoniae. A total of 1204 blood sera samples of sows were examined.

Table 1

**Test results of blood serum of sows for *Mycoplasma hyopneumoniae***

Farms	No. examinations sera	No. positive	% positive	No. negative	% negative
Farm 1.	256	124	48,43	132	51,56
Farm 2.	230	136	59,13	94	40,86
Farm 3.	211	143	67,77	68	32,22
Farm 4.	207	26	12,56	181	87,43
Farm 5.	198	41	20,70	157	79,29
Farm 6.	102	0	0	102	100
Total	1204	470	39,03	734	60,96

Antibodies against *M. hyopneumoniae* were established in 470 ( 39,03 %) sera of sows. The percentage of positive sera differed among the farms, ranging from 0-67,77%. The results of the investigations have shown that infection with *M. hyopneumoniae* is present in sows on 5 of 6 examined farms. The prevalence of infection with *M. hyopneumoniae* was lower than in our previous studies (Žutić et al., 2008). This is probably the result of serological control of gilts prior to fertilization.

Enzootic pneumonia caused by *M. hyopneumoniae* is a severe disease of pigs, causing significant economic losses to the pig industry worldwide (He et al., 2011).

*M. hyopneumoniae* is the causative agent of enzootic pneumonia, but more importantly, it is a primary component of the porcine respiratory disease complex (PRDC).

Both disease conditions cause major economic losses to the swine industry mainly due to reduced growth, poor feed conversion, increased medication costs and increased mortality.

The microorganism adheres to and damages the ciliated epithelium of the respiratory tract. The microorganisms attaches to the cilia in the airways. This causes clumping of cilia, loss of cilia and excessive production of mucous. The mucociliary apparatus is thus impaired causing reduced clearance of inhaled particles and making the respiratory tract more susceptible to opportunistic infections. The incubation period is dose dependent. With high doses the incubation period is 10 days and low doses cause subclinical chronic infections. Affected pigs show chronic coughing, are more susceptible to other respiratory infections and have a reduced performance (Thacker, 2004).

Innate immunity is important in determining the outcome of the initial interaction between pathogenic mycoplasmas and their hosts by helping confine the organisms to their natural ecological niches as mucosal parasites of upper respiratory tracts. *M. hyopneumoniae* is typically introduced into pig herds by the purchase of subclinically infected animals or, less frequently, through airborne transmission over short distances. Once in the herd, *M. hyopneumoniae* may be transmitted by direct contact from infected sows to their offspring (Sibila et al., 2009).

This organism is ubiquitous within swine herds throughout the world. By itself, *M. hyopneumoniae* is minimally pathogenic. But in mixed infection with other respiratory

pathogens such as bacterial species, or with viruses, *M. hyopneumoniae* induces more severe pneumonia than when alone.

*M. hyopneumoniae* induces the production of proinflammatory cytokines leading to inflammatory changes in the lung that diminish the capacity of the immune system to control other respiratory pathogens, including porcine reproductive and respiratory syndrome (PRRS) virus, thereby exacerbating pneumonic lesions and contributing significantly to the PRRS disease complex.(Thacker, 2006). The lesions may be exacerbated further by secondary infection with *Actinobacillus pleuropneumoniae* or with opportunistic pathogens such as *Pasteurella multocida*, *Bordetella bronchiseptica* and *Haemophilus parasuis* (Desrosiers, 2001).

Isolation of mycoplasmas from clinical specimens is therefore a long process (usually 3-4 weeks) that requires a specialized laboratory. Numerous polymerase chain reaction (PCR) assays have been developed as alternative diagnostic methods, but they are not always sensitive or species specific (Whithear and Browning, 2004).

Serodiagnosis is used routinely to assess infection of *M. hyopneumoniae*. Numerous serological assays for detection of antibodies to *M. hyopneumoniae* have been developed, which include complement fixation test (CFT), agglutination test, indirect hemagglutination (IHA), and enzyme-linked immunosorbent assay (ELISA). Compared with IHA and CFT, ELISA is generally more sensitive and antibodies can be detected more than 1 year postexposure(Ameri-Mahabadi et al.,2005, Marois,2006). Seropositivity for *M. hyopneumoniae* in sows, as assessed by commercial ELISA, is a possible indicator of infection pressure among sows.

Risk factors for the spread of *Mycoplasma hyopneumoniae* in sows have not been studied although vertical transmission from sows to their offspring is considered a significant risk factor in the development of enzootic pneumonia in growers and finishers.(Gosse et al., 2009).

Optimizing management and housing conditions is primordial in the control of *M. hyopneumoniae* infections and should be the first to be accomplished. Instituting management changes that reduce the possibilities of spreading pathogens or result in decreased lung damage by other pathogens may significantly improve the control of enzootic pneumonia ( Maes,2010).

Antibiotics are also used in the treatment and prevention of *M. hyopneumoniae* infections, but timing is a real problem. Treating too late or too early is ineffective, so it often needs to be continued over an extended period (Christiansen and Szancer, 2006).

Commercial vaccine are also widely used to control *M. hyopneumoniae* infections. The main effects of vaccination include less clinical symptoms, lung lesions and medication use, and improved performance. However, bacterins provide only partial protection and do not prevent colonization of the organism. Different vaccination strategies (timing of vaccination, vaccination of sows, vaccination combined with antimicrobial medication) can be used, depending on the type of herd, the production system and management practices, the infection pattern and the preferences of the pig producer (Erlandson et al.,2002, Maes et al.,2008).

The following risk factors reported to have an impact on mycoplasma pneumoniae: air volume, stocking density, sow characteristics, production system (all in/all out, continuous), construction of building, access to water, ventilation, light, draft, hygiene, temperature, humidity, gases, bioaerosols, dust, distance to possibly infected farm, feeding technique, characteristics of manager etc.

### 3. CONCLUSIONS

The identification of serologically positive animals, in particular gilts, prior to their introduction into breeding activities, forms the basis of controlling and eliminating the disease, while at the same time it enables an evaluation of the degree of infection of each controlled herd. Similarly, serological examinations provide insight into the seroconversion of each individual animal according to certain technological categories within the herd.

The successful control and elimination of mycoplasma pneumoniae depends on the efficiency of preventing intra- and inter-farm transmission of the infection. Optimal results can be achieved with the implementation of reliable serological diagnostic methods. Serological diagnostics of infections caused by *M. hyopneumoniae* is an essential means for the identification of latently infected herds, the spread of the infection along the animal categories, control of animals in quarantine, the elimination of the infection from the herd, as well as for evaluating the results of the immunoprophylaxis.

The serological control of gilts is of particular importance because the detection of infected animals prior to fertilization is of vital importance for the successful control and elimination of the infection. This is due to the fact that, following partus, sows transfer the infection to their litter who fall ill early during breeding or even before that. According to the experience so far of numerous authors, the use of the ELISA test is believed to be a reliable method in serological diagnostics of mycoplasma pneumoniae, in different age categories of animals taking part in farm or individual breeding.

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## **ESTIMATION OF PRODUCTIVE QUALITIES OF THE MOLDAVIAN TYPE OF BLACK AND WHITE BREED**

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**Key words:** bovines, new type, Black and White breed, milk production.

### **SUMMARY**

In the Republic of Moldova is created the new Moldavian type of Black and White breed with the genetic potential at the level of 4,5-6,0 kg of milk with fat content of 3.6%. The new type is obtained on the basis of an improvement in the local populations of the Simmental and Red Steppe breeds with the use of imported bulls of the Black and White and Holstein breeds. New type animals have well developed milk udder, they are suitable for the machine milking and the breeding both at the small dairy farms and on industrial type complexes.

Considering the importance of the dairy industry in providing the population of the Republic of Moldova with valuable food, there was performed a number of significant scientific, technological, economic, organizational and technological measures for its intensification.

The main increase in milk production is provided mainly by improving the productivity of cows. At the same time more than 70% of increase in milk production in cows is achieved through improved animal nutrition, and the rest should be achieved through the implementation of the selection program for breeding of a new type of livestock.

In terms of industrial technology of milk production, from an economic point of view, breeding of cows with the productivity less than 4,000 kg of milk per year is not justified. Farms specialized in milk production will be profitable only when they are recruiting high-yielding animals that are well adapted to the specific conditions of industrial technology.

The herd for these farms should consist of animals, characterized by high yield of milk providing the highest yield of dairy fat and protein per lactation, that are giving milk easily and quickly while milking at high performance parlor units, well-paying food products, which to a large extent determines the efficiency of production.

Cattle breeds that were bred in the country - Simmental and Red Steppe and their hybrids in Jersey breed, had a low potential for milk production, poor adaptability to machine milking, therefore, did not satisfy the requirements of industrial dairy farming.

Therefore, for research staff of Institute of Animal Husbandry and Veterinary Biotechnology of the Republic of Moldova by selectionists of breeding farms and farms, were given the task to transform bred in the country breeds and their crossbreeds with the Jersey breed in the highly productive specialized type of dairy cattle by interbreeding with the gene pool of the best foreign species in dairy productivity. There have been developed appropriate programs in breeding a new type of dairy cattle with the genetic potential of 5000-6000 kg of milk.

## 1. MATERIAL AND METHOD

### Breeding methods of the Moldavian type of Black and White cattle

There was developed a scheme of breeding, provides for removal of the Moldavian type Black and White cattle with two subtypes of zonal "North" and "South". There was planned staged use of bulls-breeders of improving the breed. On the basis of breeding Simmental (S), "North" zone subtype, Black and White bulls (BW) were used to obtain half-breed animals (F1), and the Red Steppe breed basis (CS), "South" zone subtype, they were used to obtain animals of the second generation (F2). In the future, for hybrids SxBW, CSxBWxBW there were used purebred Holstein bulls (H), then hybrids, with a share of Holstein genes at the level of 75-87%, and in some cases, the derivation of "Southern" zone subtype, manufacturers with a low proportion of Holstein genes breed. There was developed target standards such as the Moldavian type of Black and White cattle that are listed in the table. 1.

Table 1

**Targeted Standards for Moldavian type of Black and White cattle**

Indicators	For cows zonal subtypes			
	"north"		"south"	
	<i>I lactation</i>	III lactation and older	<i>I lactation</i>	III lactation and older
Yield of milk per year, kg	3800-4000	5000-5200	3500-3800	4800-5000
Fat content, %	3,6-3,7	3,6-3,7	3,6-3,7	3,6-3,7
Live weight, kg	500-530	575-600	450-500	530-550
The rate of milk flow, kg / min	1,6-1,8	1,6-1,8	1,6-1,8	1,6-1,8
Height at the withers, cm	130	132-134	128-130	130-132

Height at the withers bulls should be 148-150 cm, body weight 950-1000 lbs. When growing heifers for herd renewal for the whole period of growth there was planned to get an average of 650 g daily gain. At the same time at different ages, they must meet criteria for the period from birth to six months, 700 g, in the period 6-12 months 680 g, of 12-18 months 660 g, 18-24 months, 600g. This level of growth should provide a live weight of heifers by 18 months of age by 380-400 kg.

## 2. RESULTS AND DISCUSSIONS

At the first stage of studies there was conducted a comparative assessment of the productive qualities of cows of local populations of Simmental and Red Steppe breed cows and imported Black and White breed contained on a farm in North Zone (tab.2).

Table 2

**Productivity of cows during the first lactation**

Indicators	Breed		
	Black and White	Red Steppe	Simmental
Number of cows	27	32	23
The number of milking days	302±1,3	294±2,9	302±1,5
Live weight, kg, ,	458±7,7	428±7,2	497±8,3
The milk yield per lactation, kg	3339,3±64,5	2926,2±66,9	3001,1±102
Fat content, %	3,50±0,03	3,57±0,04	3,60±0,03
Protein content,%	3,22±0,03	3,23±0,02	3,32±0,04
The quantity of dairy fat, kg	116,9±2,1	104,4±2,5	108,0±3,7
Natural milk per 100 kg of live weight, kg	729,0±17,0	683,6±21,4	603,8±20,9
Milk (4% fat) per 100 kg of live weight, kg	637,9±14,9	610,3±19,1	543,5±27,6

The best indicators of milk production in cows were established by Black and White breed, which exceeded Simmental and Red Steppe cows by 338 and 413 kg respectively. Indicators of fat and protein content in milk were practically identical, but the amount of milk fat was higher in Black and White cows. More milk fat natural in terms and equivalent of four-percent milk obtained from Black and White cattle per 100 kg of live weight. According to this index Simmental cows had the lowest rates.

Applicability appraisal of cows to machine milking showed that cows of Black and White breed had a higher rate of milk production and the most voluminous udder. To create a Moldavian type of Black and White breed according to the method of absorptive interbreeding used improving Black and White cattle and Holstein breeds imported in the period 1971 – 1976 years. from Estonia, Ukraine, Moscow, Leningrad and Kaliningrad regions. According to genealogy 27.5% Black and White bulls belonged to the Dutch line of bull Annas Adema 30587. The highest milk production of cows (6539-6135 kg) were characterized by the producers of lines Hiltes Adema 37 910, 31 652 and Niko Lindberg H-2363.

The program for breeding of a new type of dairy cattle included four stages of its implementation:

Stage I - 1975-1980 years. Preparation, cultivation, identification hereditary qualities and approbation of the first generation (F1).

Stage II - 1981-1985 years. Preparation, cultivation, identification hereditary qualities and approbation of intermediate genotypes (F2), checking the quality of bulls by offspring selection of the best renovation bulls of local breeding for breeding at elevere.

Stage III - 1986-1990 years. Preparation, cultivation, identification hereditary qualities and approbation of intermediate genotypes of Moldavian Black and White cattle (F3), the selection of the sons of the bulls - improvers for laying new lines of local selection.

Stage IV - 1991 - 2000 years. Reproduction, evaluation and selection of breeding material desired type, evaluation of new lines, the formation of the genealogical structure of Black and White cattle of Moldavian-type, conducting its approbation.

Indicators of used bulls that improve the breed to create the Moldavian population of Black and White breed listed in the table. 3.

Table 3

**Characteristics of cattle breeds improving for the productivity  
of the nearest ancestor**

Years	Average indicators						
	Number of heads	Productivity for higher lactation					
		Mother			Father's mother		
		yield of milk, kg	fat, %	fat, kg	yield of milk, kg	fat, %	fat, kg
1976-1980	Stage I						
	176	5912	3,98	235,3	6582	4,31	259,3
1981-1985	Stage II						
	150	6381	3,97	253,3	8384	4,11	344,5
1986-1990	Stage III						
	115	8098	4,14	335,2	9659	4,22	407,6
1991-2000	Stage IV						
	87	8185	3,93	321,6	10245	4,22	432,3

The use of breeder bulls with high genetic potential for milk production has improved breeding and productive qualities of farmed animals, as evidenced by the growth of milk production of animals made in 1989 - 4025 kg of milk on average over the entire population of Moldavian type of Black and White breed.

Thus from 1980 to 1990 there was an increase in the number of farms with productivity more than four thousand, but 11.8 times reduced the number of farms with less productive of cows 3.0 thousand kg of milk (tab.4).

The results of evaluation of productivity of cows in the third stage are shown in table 5.

Table 4

**Distribution of households by the level of milk production of cows**

Year	Total farms	Number of farms with milk yield						
		Up to 3000	3001-3500	3501-4000	4001-4500	4501-5000	5001-5500	6000 and higher
1980	965	665	229	69	2	-	-	-
1984	826	269	371	138	35	7	6	-
1985	827	107	404	253	68	10	5	-
1986	839	105	386	252	67	19	10	-
1987	843	95	319	260	125	27	16	-
1988	840	19	187	257	250	55	25	1
1989	834	19	131	300	255	33	42	3
1990	813	56	143	275	214	72	50	8

Table 5

**Productivity of cows**

The combination of breeds	n	Productivity of cows		± to the standard of the type	
		milk, kg	fat, %	milk, kg	fat, %
North subtype					
SxHxHxH	162	5616 ±69,2	3,59±0,007	+2016	-0,01
SxBWxHxH	149	5318 ±76,0	3,58±0,009	+1718	-0,02
SxBWxBNxH	19	5092±222,2	3,58±0,019	+1492	-0,02
BWxHxHxH	136	5535 ±71,2	3,62±0,006	+1935	+0,02
The average for the North subtype	466	5476 ±41,4	3,60±0,003	+1876	0
South subtype					
RSxHxHxH	22	5431±259,4	3,68±0,050	+2031	+0,08
RSxBWxHxH	134	5491± 88,5	3,61±0,024	+2091	+0,01
RSxBWxBWxH	35	5225±205,9	3,78±0,022	+1825	+0,18
RSxBWxBWxH	67	5135±144,0	3,53±0,027	+1735	-0,07
RSxBWxHxBW	21	4482±172,9	3,68±0,067	+1082	+0,08
The average for the South subtype	279	5291± 66,9	3,62±0,015	+1891	+0,02

During the third stage of creation of the Moldavian type of Black and White breed satisfactory results were received. Cows of Northern subtype had milk productivity in the first lactation, on average 5058 kg, and the third lactation and older from 5.1 to 5.6

thousand kg of milk and exceeded the target standard, an average by 1876 kg. According to the content of the milk they were at the level of standard requirements.

The results of evaluation of productivity of cows in the fourth stage are shown in table 6.

Table 6

Productivity of cows					
Proportion of Holstein genes	n	Productivity of cows		± to standard of type	
		milk, kg	fat, %	milk, kg	fat, %
North subtype					
25-50	75	4249±128,2	3,55±0,010	+ 449	-0,05
51-75	604	5145± 38,4	3,58±0,040	+1345	-0,02
76-87,5	1302	5224± 26,4	3,58±0,002	+1424	-0,02
90 and higher	342	4578± 37,7	3,59±0,004	+ 778	-0,01
On average	2323	5077± 20,0	3,58±0,002	+1277	-0,02
South subtype					
25-50	273	4862± 72,6	3,69±0,010	+1262	+0,09
51-75	850	4634± 58,9	3,71±0,010	+1034	+0,11
76-87,5	487	3938± 58,7	3,74±0,007	+ 338	+0,14
90 and higher	68	3423± 81,9	3,75±0,018	- 177	+0,15
On average	1678	4420± 37,8	3,72±0,06	+ 820	+0,12

During the fourth and last stage of creating a new type of livestock, milk production of cows in Northern subtype was higher than the standard, on average by 1277 kg per year, but lower than during the third stage. This is caused by that in the last stage of work the Moldavian type of Black and White breed Holstein genes share was higher than in the previous stage, but there was not created conditions for the manifestation of feeding the genetic potential for these animals. For the cows of the Southern subtype, for the same specified reason, the average milk yield also was lower than in the previous stage. Should be noted that for the Southern subtype on average fat content in milk, in comparison with the Northern subtype, tends to increase. The rate of milk production in cows for both subtypes was fairly high and made 1.8 kg per minute.

### 3. CONCLUSIONS

As a result of breeding programs in the Republic of Moldova a new type of population of Black and White cattle was bred, with dairy productivity and genetic potential at the level of 4,5-6,0 kg of milk with fat content of 3.6%.

The structure of the Moldavian type of Black and White cattle at the present stage includes two zone types: "northern", bred from the Simmental breed basis and "southern", from the Red Steppe breed basis.

Increasing of breeds for improving species up to 75% (hybrids F2 and above) resulted in increased milk production compared with the original, native populations of Simmental and Black and White breeds.

Crossbreeding of the original breeds with black and motley and Holstein bulls led to a reduction of fat content in milk of cows of Northern and Southern subtypes. At the same time the total yield of milk fat per lactation increased by 19,5-27,1 and 15,0-26,0 kg.

Cow of first lactation obtained by crossbreeding of the original breeds with Holstein bulls are more conform to the requirements of target standards than their counterparts obtained in crossbreeding with Black and White bulls.

The results of IV stage of breeding of the Moldavian type Black and White cattle have shown that a further increase in the proportion of genes of improver breed in the Republic of Moldova did not increase milk production. Animals with genes share from 50 to 87.5% (5145-5224 kg of milk with fat content of 3.58%) differ by the highest milk yield in the "northern" zonal subtype, whereas animals with 90% of Holstein genes and more had a lower milk production. The best genotypes in the "southern" zonal subtype were animals with a share of Holstein genes at the level of 50-75%. Excess over the target standards averaged at 1277 and 820 kg respectively for the "northern" and "southern" zonal subtypes.

All cows of new subtypes had the desired shape of udder and the rate of milk production ranged from 1.7 to 2.0 kg / min.

Evaluation results of 16 033 cows of first lactation by economically useful features indicate that qualitatively new population of animals in all respects exceeding the original Simmental and Red Steppe breed is derived.

Evaluation of bulls by the quality of the offspring in the Republic of Moldova farms has revealed the most valuable breeder bulls and highlight 5 main lines in the structure of the Moldavian type Black and White cattle.

Animals of the "northern" and "southern" zonal subtypes differed by more stable nature of the lactation curve in comparison with the original breeds.

The further work with the Moldavian type of Black and White cattle requires:

1. Develop a program to improve the breeding and productive qualities of the Moldavian type Black and White cattle in the formation of private and farming households for 2002-2010.

2. Breeding of animals with a share of Holstein genes at the level of 75-87,5% in the "northern" zonal subtype and at the level of 50-75% in "Southern" zonal subtype.

3. Evaluate by the quality of the offspring of bulls to determine improvers for use in breeding.

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**THE FORMATION AND IMPROVEMENT OF THE CONDITIONED  
REFLEXES OF THE WORKING DOG WITH THE PURPOSE OF PROCESSING  
THE TRACKS OF HUMAN SCENT, DRUGS AND EXPLOSIVES**

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**Key words:** dog, breed, behavior, selection, stimulus, reflex, training, technology, trace, olfactory, osmology, search, conditioning, identification, rescue, detection

**SUMMARY**

The objectives of the research were the development of conditioned reflexes in working dogs, applicable in identifying the traces of human scent, drugs and explosives. The test consisted of the verification of certain products, methods, principles and new technologies in animal training; the improvement of the working techniques used up to the present; determining the working potential of the canine samples we had at our disposal during research; finding new, more efficient working methods; the professional training of canine samples, so as to respond promptly at operational solicitation; modernizing the Romanian dog training.

**1. MATERIAL AND METHOD**

The biological material we had at our disposal belonged to five different canine breeds (German Shepherd, Belgian Shepherd, Labrador Retriever, Bloodhound, Rottweiler), aged over 12 months.

As far as the dogs' readiness to the osmologic training is concerned, from the point of view of the race and the gender, there was no sufficient research in the field, at national level, up to the moment of the present study.

Consequently, one of the purposes of the experiments was the study of the way in which the particularities of each canine breed and the sex of the dog influence the evolution and the performance of the osmologic training. The entire group of dogs under study counted 319 samples. As far as the spreading of the entire biological material among the breeds, the situation is as follows: of the total of 319 individuals, 275 (86.2%) belong to the German Shepherd breed, 36 (11.2%) to the Labrador Retriever, 3 (1.0%) to Bloodhound, 3 (1.0%) to Rottweiler, and 2 (0.6%) to the Belgian Shepherd (Table 1).

*Table 1*

**Specimen distribution on breeds**

<i>Total specimens</i>	<i>German Shepherd</i>		<i>Labrador retriever</i>		<i>Bloodhound</i>		<i>Rottweiler</i>		<i>Belgian Shepherd</i>	
	<i>no.</i>	<i>%</i>	<i>no.</i>	<i>%</i>	<i>no.</i>	<i>%</i>	<i>no.</i>	<i>%</i>	<i>no.</i>	<i>%</i>
319	275	86.2	36	11.2	3	1.0	3	1.0	2	0.6

Regarding the gender repartition, of the total of 319 individuals, 255 (79.9%) canine samples were males and 64 (20.1%) were females (Table 2).

Table 2

**Specimen distribution on sex**

<i>Total specimens</i>	<i>Males</i>		<i>Females</i>	
	<i>no.</i>	<i>%</i>	<i>no.</i>	<i>%</i>
<i>319</i>	<i>255</i>	<i>79.9</i>	<i>64</i>	<i>20.1</i>

As a consequence of the present research, new races were introduced in the national training program, which had not been used before 2000. It is mainly the case of the Malinois Belgian Shepherd, extensively usable, and that of the Labrador Retrievers, very good in the searching / detection training.

### **MATERIALS, EQUIPMENTS AND SUBSTANCES USED IN THE TRAINING PROCESS**

In this chapter we become familiar with the entire set of materials, equipment and tools which have been used in the training process, beginning with the selection, pre-training, up to the canine perfecting, as well as all the necessary equipment, as it should comply with a professional working standard. All the materials used in the grooming and the feeding of the dogs, the dogs' training harness, the protection equipment the tools and the scent kits, materials and devices used for building up reflexes, substances used as conditioning stimulants are also mentioned.

The author's own opinion concerning the setting up of an osmologic lab, as the one already functioning within the Centre of Sibiu is presented as well.

As a consequence of the research, we also managed to set up the circumstances for using essential scents in order to create the specific reactions of dogs, we built training fields, and we regulated the manufacturing and the use of some original training devices.

At the end of our research, we have devised a logistics database for each category of training sessions; we clearly established lists of materials, equipment, devices and substances to be used in order to obtain good results in the field. Out of all these many have already been used within the working technology; due to their usefulness they have already contributed to the enhancement of the osmologic training efficiency.

Another outcome of our experiments was the setting up of a lab for scent examinations, which was designed by our own concept. All these results are the basis for the setting up of another 15 such labs in the most important counties, in the near future.

### **THE ORGANISATIONAL FRAMEWORK**

The research was conducted within an organized set of courses, which took place every year at the Cynological Centre of Sibiu.

In order to achieve optimal conditions for our studies and experiments, we needed to create and elaborate organizational documents, planning and to set into practice all of our observations.

We also needed to select a team of trainers, well educated in the field, which was not supposed to get emotionally involved in the project and to be familiar with our final purpose.

As a consequence of our research and of the experience we gathered, we gradually managed to perfect the methodology of creating the documents for the courses, to improve the procedure of setting up the training activities, and finally to create a scientific framework for organizing training courses.

The means of evaluation, which were made clear ever since the beginning of our research, are now being used at all the scent courses organized at the Centre of Sibiu. Within the same context, the training exercises and the examination items are now limited, in our Centre, at those used during our experiments, while the final grade is calculated by the formula devised by the author of the present paper.

### **THE PRINCIPLES AND THE TRAINING METHODS USED**

For a good development of the training process, certain theoretical principles need to be kept in mind. They need to be considered as guiding rules, regulating the planning of the entire procedure.

The next step following the setting up of the training principles is for the latter to be strictly observed by the trainers, or else the operational objectives cannot be fully achieved, and the results can thus be contradictory.

At the same time, in order for the selection and training work to be efficient, certain methods need to be chosen, methods that can offer appropriate solutions for the ensuing problems.

This chapter introduces the principles and methods chosen for the development of the entire training process, conducted during the present research. Following our study, the six principles introduced in the present paper, have been imposed in the training of working dogs, and they have been considered appropriate for any specific working strategy. The entire training process was conducted by respecting four training methods. At the end of our research, these methods have been used to define the training technologies exercised by the trainers at the Centre of Sibiu.

### **THE WORKING TECHNOLOGIES USED IN TRAINING**

The majority of our studies concentrated upon the discovery of new working methods in the osmologic training, methods which would replace previous techniques, considering the fact that the latter had become difficult to use, superficial, quite unrealistic, and with very little scientific basis.

The main purpose of our experiments was, first of all, to make the existing technologies more efficient, and secondly, to find new working methods, which would meet the requirements of important training specializations that had not been dealt with in Romania, up to the present.

The results we obtained confirmed the fact that all the technologies under experiment were better than the ones previously used, both from the point of view of an easier work, and especially from that of rendering the training more efficient, of bringing it closer to the requirements of the actual situation.

The most important changes consisted of:

- a stricter selection of the samples chosen, keeping in mind the standards, set up in close connection with the objectives;
- the use of stimulating working methods during training, which would exploit the natural instincts of dogs;
- the use of an extremely large variety of reflex forming stimuli, so that the possibility of negatively influencing the performance of the dog to be close to zero;
- providing all the necessary materials for these activities by starting to use various sets of items, equipment, devices and substances;
- the enhancement of a strict attitude towards the work and its results, considering that only those cynotechnical couples who prove their value receive good appreciations.

All the techniques and methods improved by means of personal researches have been introduced into training, being now made available for the trainers of the Cynological Centre of Sibiu, in order to be used within this process. Along with the improved technologies, new ones have been created. After having proved their usefulness, they were approved and used, some of them ever since 2006 (such as the specialization in searching and rescuing missing persons), and others starting with 2008 (for the specialization in scent identification).

## 2. RESULTS AND DISCUSSIONS

Following the analysis of the collected data, certain conclusions arise, concerning the percentage of specialization of the dogs, the individual performance categories, the final grades obtained at training, the gender of the specialized dog samples and the race they belong to.

### 2.1. SPECIALIZATION PERCENTAGE

The percentage of canine samples eliminated at the beginning and during the course reached 20%. This was due to their lack of training qualities related to the respective specialization, to some severe medical problems, but also to other reasons, connected with the handlers.

Table 3

**Specialization percentage in tracking course, per series**

<i>Course series</i>	<i>Initial specimens</i>	<i>Specialized specimens</i>	<i>Percentage</i>
<i>Tracking</i>	<i>114</i>	<i>85</i>	<i>75%</i>
<i>Identification</i>	<i>5</i>	<i>4</i>	<i>80%</i>
<i>Rescue</i>	<i>35</i>	<i>28</i>	<i>80%</i>
<i>Cadavers</i>	<i>9</i>	<i>9</i>	<i>100%</i>
<i>Drugs</i>	<i>55</i>	<i>42</i>	<i>76%</i>
<i>Explosives</i>	<i>101</i>	<i>87</i>	<i>86%</i>
<b><i>TOTAL</i></b>	<b><i>319</i></b>	<b><i>255</i></b>	<b><i>80%</i></b>

As you can see in Table 3, the highest percentage of specialization was noticed at the cadaver detection course, and the lowest, at the tracking course. One of the

explanations would be the fact that the two courses are exactly opposite from the point of view of the level of difficulty. The tracking course is the most difficult training course and, as a consequence, the task of selecting dogs to meet the criteria of the course is quite problematic. It is not the case of the buried human cadaver detection course, as this a course that relies on strong instincts; as the conditioned reflexes to be developed here are not so complex, the selection procedure is simpler.

## 2.2. PERFORMANCE CATEGORIES

The average performance category for each specialization can be calculated by multiplying the total of each category with a number equal 1 (for the first category), 2 (for the second category), 3 (for the third category) and 4 (for the fourth category), and then making their sum and dividing it to the total number of individuals in each specialization.

Table 4

**Average performance category for each speciality**

<i>Work category</i>	<i>I categ. individu als total no. x 1</i>	<i>II categ. individu als total no. x 2</i>	<i>III categ. individu als total no. x 3</i>	<i>IV categ. individu als total no. x 4</i>	$\Sigma$	<i>Average: <math>\Sigma</math>/individuals tot. no.</i>
<i>Tracking</i>	58	50	6	0	114	1,34
<i>Identification</i>	1	4	3	0	8	2,00
<i>Rescue</i>	1	10	54	16	81	2,89
<i>Cadavers</i>	2	12	3	0	17	1,89
<i>Drugs</i>	3	34	60	8	105	2,50
<i>Explosives</i>	13	76	108	0	197	2,26

Obviously, as far as the index of the performance category is concerned, the best ranking course is the tracking one, followed by the cadaver detection one. The search and rescue missing persons course is ranked last, and prior to it is the drug detection course.

## 2.3. THE GENDER OF THE SAMPLES

This criterion could only be studied in the case of three specializations (search and rescue missing persons, drug detection, explosive detection), as these were the only ones to have accepted samples of both genders.

Even if, in some cases the females obtained better results than the males, we can safely state that the influence of gender is not essential in training (Table 5). However, due to problems connected especially with menstruation, males are preferred in the osmologic training.

Table 5

**Average marks, depending on specimens sexes**

<i>Males</i>			<i>Females</i>		
<i>Obedience</i>	<i>Speciali- zation</i>	<i>General average marks</i>	<i>Obedience</i>	<i>Speciali- zation</i>	<i>General average marks</i>
7,89	8,39	8,23	7,66	8,50	8,25

## 2.4. DOG BREEDS USED IN TRAINING

As a conclusion to our research, we can state that the Labrador retriever is more adequate for drug and explosive detection specializations than the German Shepherds, as the results obtained by the Labradors are obviously superior to the ones obtained by the German Shepherds (Table 6).

Table 6

German Shepherd			Labrador retriever		
Obedience	Speciali- zation	Gen. av. marks	Obedience	Speciali- zation	Gen. av. marks
8,06	8,69	8,50	8,49	9,06	8,89

For all the other specializations, the German Shepherds proved to be more adequate to training.

## 3. CONCLUSIONS

Following the researches here are the conclusions:

- It is very important to be aware of the origin of dogs and the process of taming them in order to understand the place of the dog in the evolution of man.
- For an efficient and performing training, the first step is to understand a dog's behavior and to explore its instincts.
- The training means, in fact, to modify the individual behavior in the way the human being wants, as it is a process of adaptable learning, not only a conditioned reflex as I.P. Pavlov sustained.
- The stimulants used in the osmological training are perceived sensorial by the dog, especially by the sense of smell, auditory and visual.
- The training of the dog is more efficiently using both the stimulative method and the mechanical one.
- The researches were made on 5 main dog breeds and the most suitable one was the German shepherd. The most specialized breed is Bloodhound - only in the olfactory section of the tracking training.
- The selection of the biological material was made after 4 main tests:
  - Before starting the training;
  - During the pre-training;
  - In order to get to the specialization course;
  - At the end of the specialization course;
- The dogs' selection regarding its training abilities and its temperament were made by using the Volhard test and the Campbell test. These tests are very good because they offer you a clear image of the abilities and potential of each specimen verified using them. They are easy to apply and they do not need an exigent material insurance. They are recommended in testing all the dogs of around 2 months.
- The study was done during 5 years.

- There were 319 dogs - evaluated, selected, observed and investigated.
- The distribution of the biological material on breeds was in this way: 279 (87,4%) German Shepherd; 32 (10,0%) Labrador Retriever; 3 (1,0%) Bloodhound; 3 (1,0%) Rottweiler; 2 (0,6%) Belgian Shepherd.
- The distribution about sex - 255 (79,9%) males and 64 (20,1%) females.
- 6 types of specialties were studied - tracking, scent identification, search and rescue missing persons, human remains detection, drug and explosive detection.
- The studied dogs had 25 training courses during 4 or 26 weeks the length of each course depending on its specialty.
- The courses were in accordance with the Curriculum, the thematic programs, analytic programs and the schedules approved by the Ministry of Administration and Interior.
- For a training in a good and efficient condition there were used the following materials, equipments and substances: performing harness, safety protection equipment, objects for stimulating instincts, sources of smell made according to current legislation, a complete set of drugs and explosive materials, liquid cadaverous smell. The training couldn't be efficient without a proper material endowment and the results couldn't be performing.
- On the research period we obtained and used, with very good results, a biological product with cadaverous smell, distilled, centrifuged and ampouled which got a patent as an invention by the State Office for Inventions Bucharest in 30.01.2006. This substance is the best product in this field, considering that the Romanian law does not allow using human being remains, and the dogs trained with the help of this substance had very good results in the operative missions for finding human remains, victims of murders or natural calamities.
- The training process was developed by respecting the 6 principles and 4 methods of training.
- The training of the over 300 dogs was made using new or improved technologies. The results confirmed the fact that all the technologies used are more efficient and easier to apply. The technologies made or improved by our own researches were already introduced in training, being applied by the instructors of the Dog Training Center in Sibiu.
- The evaluation of the dogs was made using points between 1 and 5 (1 - maximum) and giving them accordingly. And the final examination is made by counting the average. This evaluation has to be made after unique methodologies, in detail, taking account about the evaluated proof, the given points and the mistakes. The system is very efficient in order to have an exact image of all of the dogs you work with.
- After counting the average the dogs have a performance category from I to IV (I maximum). It is a system made by us for a correct evaluation of the dogs' abilities in order to make a distinction between the best dogs and the rest, in the event of an especially demanding situation. These methods were appreciated by specialists from foreign countries and from our own country as they all were interested in using this method.

•The percentage of specialization through the courses was between 75 and 100%, with an average about 80%, which means that from 100 dogs presented to the course, 80 finished and were certificated for their category. The smallest percentage was to the tracking dogs and the highest one to the cadaver dogs.

•Concerning the performance categories, the most efficient course was the tracking one followed by the one for buried human remains detection. On the last place it was the course of search and rescue missing persons and last but not one that for drug detection. The initial selection of the dogs for these courses was not made in Sibiu but in another centre that doesn't exist anymore.

•Following the research, we can observe that Labrador Retriever breed is good for drug and explosive detection, more recommended than the German Shepherd. For the other specialties the German Shepherd is recommended because is the best breed for training.

•The influence of sex is disregarded in training even if the female had better results in some tests than the males. Even so, generally, in training the males are preferable to be chosen because of the biological sexual cycle of the females.

•After processing the results we can say that training is compact, the one for specialization surpassing the disciplinary one.

•**Final conclusion:** The dog is the only animal with special qualities, both for rescuing and protecting the human being and for finding, identifying or searching traces of human smell or some substances which are objects of illegal consume and commercialization (drugs) or other materials used as explosives, in arsons, and other categories of odorous traces (cadaverous one). The dog proves to be useful in finding and in the identification of authors of illegal acts, saving people, finding judiciary proof, preventing potential offences and discouraging them.

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**RESEARCH ON THE SITUATION OF AGRICULTURAL LAND AND  
LIVESTOCK EXPLOITED IN THE ORGANIC SYSTEM IN  
EUROPEAN UNION**

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**Key words:** organic agriculture, agricultural land, livestock.

**SUMMARY**

Organic farming can be defined as a method of production which places the highest emphasis on environmental protection and animal welfare considerations. The aim of this paper was to analyze the situation of organic agriculture in the European Union, especially regarding the organic areas and livestock sector. The total organic agricultural land area in EU 27 is 8,346,374 ha, which representing approx. 90% of organic farmland in Europe and approx. 22% of the world. 208,927 organic producers were reported in 2009 in EU 27. Regarding the use of organic agricultural land in 2009, worldwide were 61.7% occupied with permanent grassland, 14.8% with arable land, 3.1% with permanent crops and 20.4% had other purposes than those mentioned above, while in Europe the situation is as follows: 46% permanent grassland, 40% arable land, 11% permanent crops and 3% other destinations. In the organically reared livestock, the number of cattle was 2,558,619 heads in 2009, representing approximately 2.9% of total EU cattle number, sheep 3,484,092 heads (3.4% of the total number), goats 577,613 heads (4.8% of the total number), poultry 23,765,833 heads (1.8% of the total), and pigs 642,426 heads (0.4% of the total number). Thus, these data show that goats, sheep and cattle are the most popular species reared using organic production methods.

**1. MATERIAL AND METHOD**

The aim of this paper was to analyze the situation of organic agriculture in the European Union, especially regarding the organic areas and livestock sector. For achieving this goal we have studied the official statistical data, we calculated the percentage differences between the reference years and we interpret the obtained data.

**2. RESULTS AND DISCUSSIONS**

Organic farming can be defined as a method of production which places the highest emphasis on environmental protection and animal welfare considerations. In the EU, farming is only considered to be organic if it complies with Council Regulation (EEC) No 834/2007. The detailed rules for the implementation of this Council Regulation on organic products and the labelling of organic products are laid down in Commission Regulation (EC) No 889/2008. Organic farming involves holistic production management systems for crops and livestock, emphasizing the use of management practices in preference to the use of off-farm inputs. This is accomplished by using, where possible, cultural, biological and mechanical methods in preference to synthetic chemical units such as fertilisers, pesticides (fungicides, herbicides and insecticides), additives and medicinal products.

Table 1

**Organic agricultural land, share of total agricultural land and number of producers in EU countries in 2009** (source: Willer, H. and Kilcher, L., 2011)

<b>Specification</b>	<b>Organic Agr. Land (ha)</b>	<b>Share of Total Agr. Land (%)</b>	<b>Organic Producers (number)</b>
Belgium	41,459	3.02	997
Bulgaria	12,320	0.4	379
Czech Republic	398,407	9.38	2,665
Denmark	156,433	5.88	2,694
Germany	947,115	5.59	21,047
Estonia	95,167	10.49	1,277
Ireland	47,864	1.16	1,328
Greece	326,252	3.94	23,665
Spain	1,330,774	5.35	25,291
France	677,513	2.46	16,446
Italy	1,106,684	8.68	43,029
Cyprus	3,816	2.61	732
Latvia	160,175	9.03	4,016
Lithuania	129,055	4.87	2,652
Luxembourg	3,614	2.76	77
Hungary	140,292	3.32	1,617
Malta	26	0.25	12
Netherlands	51,911	2.69	1,413
Austria	518,757	18.5	21,000
Poland	367,062	2.37	17,092
Portugal	209,090	6.02	1,902
Romania	168,288	1.22	3078
Slovenia	29,388	6.01	2,096
Slovakia	145,490	7.51	363
Finland	166,171	7.25	4,087
Sweden	391,524	12.56	4,816
United Kingdom	721,726	4.47	5,156
<b>European Union</b>	<b>8,346,374</b>	<b>4.83</b>	<b>208,927</b>

The organic agricultural land, share of total agricultural land and the number of producers in EU countries in the year 2009 are presented in table 1. As can be see from existing data (Table 1) the total organic agricultural land area in EU 27 is 8,346,374 ha, which representing approx. 90% of organic farmland in Europe and approx. 22% of the world.

Figure 1 shows the top 10 countries of the EU in the area of organic land owned. Thus, in the EU, the first three positions are held by Spain, Italy and Germany, while the opposite, respectively countries which have the smallest organic area are Malta, Cyprus and Bulgaria. But if we take into account eco-owned land area of total agricultural area, things are changing (Figure 2), and the first three positions are occupied in order by Austria (18.20%), Sweden (12.56%) and Estonia (10.49 %), while the opposite is Malta (0.25%), Bulgaria (0.40%) and Ireland (1.16%). 208,927 organic producers were reported in 2009 in EU 27.

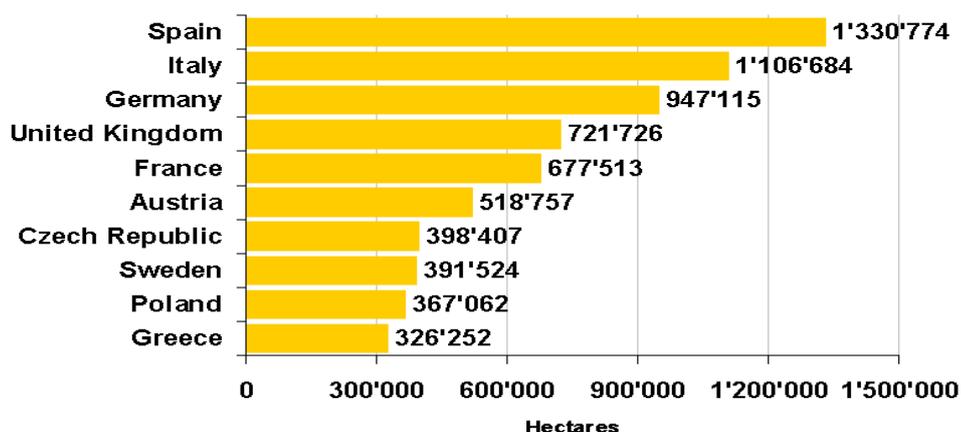


Figure 1. The ten countries with the most organic agricultural land 2009 in EU (Source: FiBL/IFOAM Survey 2011)

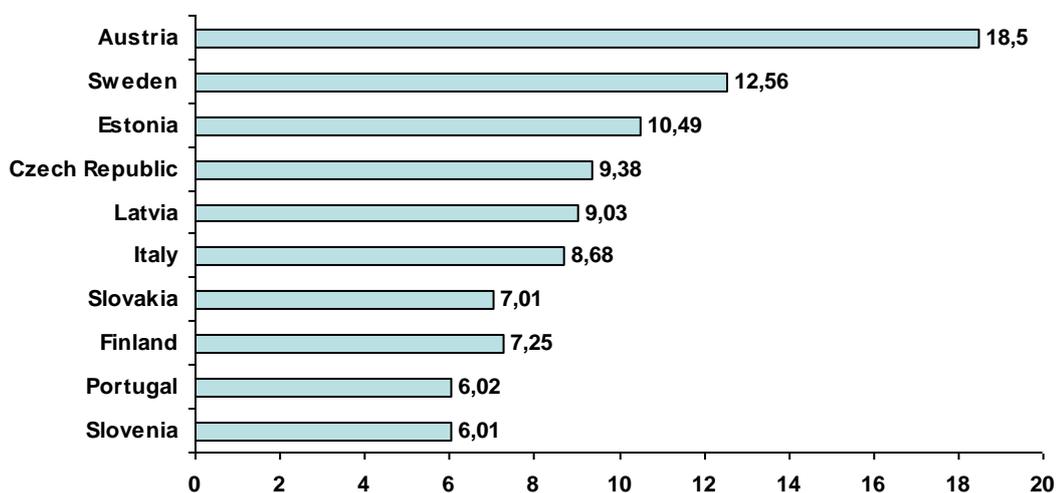


Figure 2. The ten countries with the most share of organic land from total agricultural land 2009 in EU (%) (Source: FiBL/IFOAM Survey 2011)

Regarding the use of organic agricultural land, the data in figure 3, shows that worldwide in 2009 were 61.7% occupied with permanent grassland, 14.8% with arable land, 3.1% with permanent crops and 20.4% had other purposes than those mentioned above, while in Europe the situation is as follows: 46% permanent grassland, 40% arable land, 11% permanent crops and 3% other destinations.

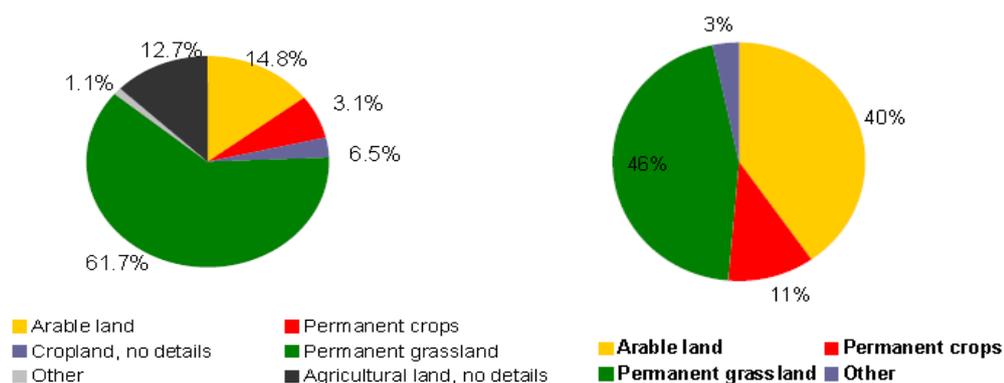


Figure 3. Use of organic agricultural land 2009 (left-Worldwide; right-Europe)  
(Source: FiBL Survey 2011)

In the organically reared livestock, from Table 2 data, can be seen that the number of cattle was 2,558,619 heads in 2009, representing approximately 2.9% of total EU cattle livestock, sheep 3,484,092 heads (3.4% of the total number), goats 577,613 heads (4.8% of the total number), poultry 23,765,833 heads (1.8% of the total), and pigs 642,426 heads (0.4% of the total number). Thus, these data show that goats, sheep and cattle have the highest share in the organic exploitation.

Regarding the situation of organically reared livestock at country level, we can see from table 2 data, that the first three positions in the number of cattle are occupied by Germany, Austria and the UK, in the number of sheep the first three positions are occupied by the United Kingdom Italy and Spain, in the number of goats the first three positions are occupied by Greece, Italy and Spain, in the number of birds the first three positions are occupied by France, UK and the Netherlands, and in the number of pigs the first three positions are occupied by Denmark, the Netherlands and Austria.

In the EU, almost of all organic milk is produced in seven countries and over 80% in four countries: Germany, Denmark, the UK and Austria. France is in fifth position. The share of direct sales is more or less strong depending on the country. It is estimated at about 40 million liters in Germany and 80 million liters in Austria. The share of organic milk in the national collection is more or less high, ranging from 15.7% in Austria and Denmark 9.4%, 6.9% in Sweden and 6.1% in Latvia to 1.9% in Germany and 1.2% in France in 2009. 30% of milk consumed in Denmark is organic and 15% in Austria. Austria and Denmark structurally sell part of their production abroad. In 2008, 110 million liters of Austrian organic milk were sold in Germany, Italy and Greece (Agence bio, France, 2010).

Table 2

**Organic livestock 2009 in EU (number of heads)**

Specification	Cattle	Sheep	Goats	Poultry	Pigs
<b>Belgium</b>	53,338	9,211	3,126	1,,230,98	10,348
<b>Bulgaria</b>	272	5,831	2,732	-	104
<b>Czech Republic</b>	1,360,26	53,038	4,352	25,292	1,990
<b>Denmark</b>	170,155	10,640	3,566	1,357,375	185,828
<b>Deutschland*</b>	403,800	235,000	0	1,188000	53,000
<b>Estonia</b>	21,074	39,374	709	8,099	328
<b>Ireland</b>	32,700	31,400	680	57,750	840
<b>Greece</b>	28,618	357,499	309,060	266,182	54,631
<b>Spain</b>	128,004	459,364	50,488	154,137	8,052
<b>France</b>	124,334	131,802	23,937	7,983,156	4,865
<b>Italy</b>	185,513	658,709	74,500	2,399,885	25,961
<b>Cyprus</b>	-	612	3,333	10,760	-
<b>Latvia</b>	53,867	31,251	7,216	33,309	9,637
<b>Lithuania</b>	21,927	13,001	755	1,510	275
<b>Luxembourg</b>	3,252	425	126	22,351	830
<b>Hungary</b>	25,089	11,123	2,066	113,939	6,447
<b>Malta</b>	-	-	-	-	-
<b>Netherlands</b>	59,000	23,000	29,000	2,500,317	85,000
<b>Austria</b>	373,720	94,130	35,899	1,227,553	69,849
<b>Poland</b>	51,391	39,159	6,333	186,311	18,664
<b>Portugal*</b>	69,097	106,682	6,525	40,736	9,499
<b>Romania</b>	8,145	51,470	4,738	9,400	603
<b>Slovenia</b>	18,238	35,751	5,569	21,904	2,149
<b>Slovakia</b>	33,486	102,134	1,516	4,324	266
<b>Finland</b>	32,354	11,935	76	175,346	2,607
<b>Sweden</b>	194,063	86,741	1,178	786,430	42,502
<b>United Kingdom</b>	331,156	884,810	133	3,958,669	48,151
<b>UE 27</b>	<b>2,558,619</b>	<b>3,484,092</b>	<b>577,613</b>	<b>23,765,833</b>	<b>642,426</b>

\*2007 data for Deutschland and 2008 data for Portugal; no data available for Malta

Source: Eurostat

The 2008 figures for organic livestock as a share of all livestock showed that, with respect to cattle, pigs and sheep, some Member States using organic methods were producing remarkably large numbers of animals, cattle and sheep being the most popular. In Austria, 25.7% of the sheep were reared using organic production methods, but organically reared cattle also achieved a noteworthy 17.7% share, the highest in the whole EU-27. Estonia had the highest percentage of the sheep population with 47.3%. As

for organically reared pigs, they accounted for less than 1% in most of the Member States (see figure 4).

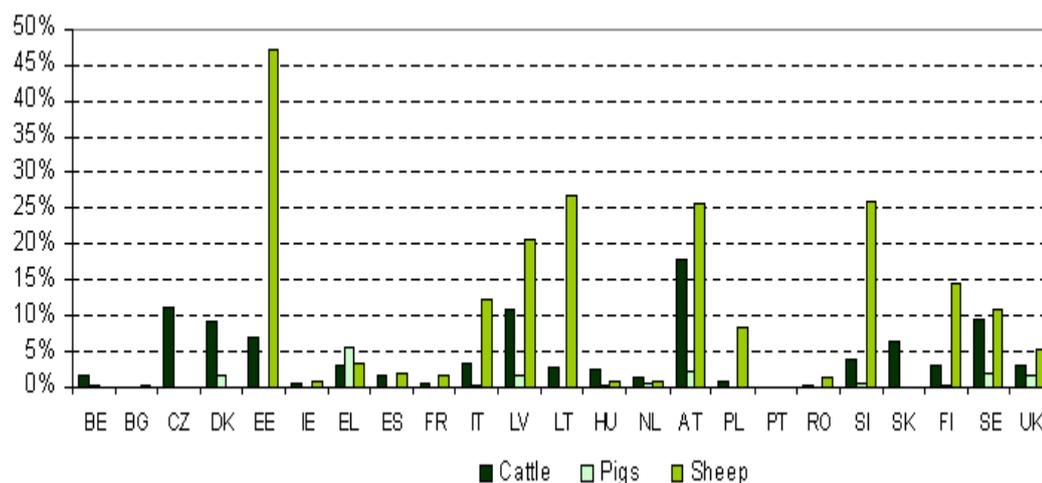


Figure 4. Organic livestock out of all livestock, 2008 (Number of heads)  
(Source: Eurostat)

### 3. CONCLUSIONS

1. The total organic agricultural land area in EU 27 is 8,346,374 ha, which representing approx. 90% of organic farmland in Europe and approx. 22% of the world. In the 2009 year 208,927 organic producers were reported in EU 27.

2. Regarding the use of organic agricultural land in 2009, worldwide were 61.7% occupied with permanent grassland, 14.8% with arable land, 3.1% with permanent crops and 20.4% had other purposes than those mentioned above, while in Europe the situation is as follows: 46% permanent grassland, 40% arable land, 11% permanent crops and 3% other destinations.

3. In the organically reared livestock, the number of cattle was 2,558,619 heads in 2009, representing approximately 2.9% of total EU cattle livestock, sheep 3,484,092 heads (3.4% of the total number), goats 577,613 heads (4.8% of the total number), poultry 23,765,833 heads (1.8% of the total), and pigs 642 426 heads (0.4% of the total number). Thus, these data show that goats, sheep and cattle are the most popular species reared using organic production methods.

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## **THE EVOLUTION OF SHEEP MEAT PRODUCTION IN THE WORLD AND EUROPEAN UNION**

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**Key words:** evolution, meat production, sheep.

### **SUMMARY**

The aim of this paper was to analyze the evolution of sheep meat production worldwide and in the European Union. World production of meat in 2009 was 283,887 thousand tonnes of which 8,240 thousand tonnes is sheep meat, i.e. 2.9% of the total. Sheep meat production worldwide has increased continuously, reaching to be with 7.5% higher in 2009 than in 2000. The average carcass of sheep worldwide in 2009 was 15.6 kg, being relatively stable in the period 2000-2009. The hardest carcasses are obtained in the North American continent (28.7 kg) and Oceania (19.2 kg) and on other continents is almost similar to the world average (15.6 kg). In the European Union, in 2009, the official production of sheep meat and goat meat was accounted to 808 thousand tonnes and the import was accounted to 271 thousand tonnes, which it means a self-sufficiency of only 75.7% and the difference must be imported from other parts of the world.

### **1. MATERIAL AND METHOD**

The aim of this paper was to analyze the evolution of sheep meat production worldwide and in the European Union, especially regarding production of sheep meat, the number of slaughtered sheep, the sheep carcass weight, the consumption and the prices for sheep meat. For achieving these goals we have studied the official statistical data, we calculated the percentage differences between the reference years and we interpreted the obtained data.

### **2. RESULTS AND DISCUSSIONS**

Worldwide there are many sheep meat producing countries, but among them are some countries such as Britain and New Zealand, where the predominant orientation is for meat production. In Britain, the orientation was to improve breeds strictly unilateral for meat production, on the basis of application of appropriate technologies, which also contributes the climate and constant humidity, which translates through high quality succulent pastures, which eventually led to getting a better quality of sheep meat. Also, in countries with advanced animal husbandry continued action to improve the specialized meat breeds and create new ones, while improving the precocity and the carcass quality of sheep breeds from around the globe.

World production of meat in 2009 was 283,887 thousand tonnes of which 8,240 thousand tonnes is sheep meat, i.e. 2.9% of the total. As a result, and the ever-increasing requirements for this product in Asian and Western countries, sheep meat became increasingly in demand in the international market, so that sheep meat production worldwide has increased continuously, reaching to be with 7.5% higher in 2009 than in 2000 (see table 1). According to FAO, world meat production of sheep arrived in 2009 to 8.24 million tonnes, achieving an annual growth rate of 0.83% in the 2000-2009 period. It

also can find that sheep meat production recorded the biggest progress in Asia (19.1%), followed by the African continent (13.9%), while production fell on other continents, the obvious decreases were seen in Europe (20.5%) and especially in EU countries (28.4%), and with smaller-scale reductions in North and Central America (3.2%), South America (5.1%) and Oceania (6.3%).

Table 1

### The evolution of sheep meat production worldwide

(Source: FAO, 2011) - thousand tonnes -

Specification	2000	2009	Differences ( $\pm\%$ ) 2009/2000
Africa	1,106	1,260	<b>+13.9</b>
North and Central America	154	149	<b>-3.2</b>
South America	253	240	<b>-5.1</b>
Asia	3,517	4,189	<b>+19.1</b>
Europe	1,413	1,123	<b>-20.5</b>
Oceania	1,213	1,137	<b>-6.3</b>
European Union	1,200	878	<b>-28.4</b>
<b>Total world</b>	<b>7664</b>	<b>8240</b>	<b>+7.5</b>

At country level, the main producer of sheep meat is China, with 2,015 thousand tonnes produced in 2009, followed by Australia with 730 thousand tonnes and New Zealand with 478 thousand tonnes of (see table 2). Significant increases in meat production in the period 2000-2009, there is especially in the countries of the Asian and African continents and in Russia, while in other countries, production has remained relatively stable or declined more or less significant.

Table 2

### Top 10 producing countries of sheep meat in 2009

(Source: FAO, 2011) - tonnes -

Rank	Countries	Production
1	China	2,014,580
2	Australia	730,143
3	New Zealand	478,167
4	Iran (Islamic Republic of)	350,663
5	United Kingdom	303,532
6	Turkey	262,998
7	India	239,766
8	Syrian Arab Republic	192,562
9	Algeria	187,000
10	Russian Federation	164,492

In the case of the number of sheep slaughtered in the world for meat production can be observed (table 3) that had as meat production, a slight increase in the period under review, rising only 6.3% higher in 2009 compared with 2000. And in this respect,

Asia recorded a higher growth compared to other continents (17.2%), with the African continent (16.0%), while on the North American continent is found a relative stagnation, while in Europe there is a significant decrease (18%), and especially in EU countries (24.6%).

Table 3

### Evolution of the number of slaughtered sheep in the world

(Source: FAO, 2011) - thousand head -

Specification	2000	2009	Differences ( $\pm\%$ ) 2009/2000
Africa	78160	90660	<b>+16.0</b>
North and Central America	6035	6060	<b>+0.4</b>
South America	19056	18427	<b>-3.3</b>
Asia	228313	267614	<b>+17.2</b>
Europe	91523	75071	<b>-18.0</b>
Oceania	63780	58917	<b>-7.6</b>
European Union	78931	59525	<b>-24.6</b>
<b>Total world</b>	<b>486919</b>	<b>517692</b>	<b>+6.3</b>

In the world, growth rate of the number of slaughtered sheep, as it was expected, is generally correlated with that of sheep meat production in all geographic regions (table 4).

Table 4

### Comparing growth rates between the number of slaughtered sheep and sheep meat production ( $\pm\%$ )

Specification	Sheep meat production	Number of sheep slaughtered
Africa	+13.9	+16.0
North and Central America	-3.2	+0.4
South America	-5.1	-3.3
Asia	+19.1	+17.2
Europe	-20.5	-18.0
Oceania	-6.3	-7.6
European Union	-28.4	-24.6
<b>Total world</b>	<b>+7.5</b>	<b>+6.3</b>

Depending on consumer food preferences (some prefer lamb and other meat from animals fattened adult) and operating system, carcass weight varies from one continent to another (table 5). The average carcass of sheep worldwide in 2009 was 15.6 kg, being relatively stable in the period 2000-2009. The hardest carcasses are obtained in the North American continent (28.7 kg) and Oceania (19.2 kg) and on other continents is similar to the world average.

Table 5

**The carcass weight of sheep (lambs + adults) worldwide**

(Source: FAO, 2011) - kg -

Specification	2000	2009
Africa	14.1	13.8
North and Central America	28.6	28.7
South America	13.6	12.9
Asia	15.4	15.6
Europe	15.4	14.9
Oceania	19.0	19.2
European Union	15.2	14.4
<b>Total world</b>	<b>15.7</b>	<b>15.6</b>

Meat of sheep provides a rate of 50-80% of meat consumption in some geographical areas as the Middle East, Central Asia and Oceania. The biggest consumers of sheep meat are the Muslim population, followed by the people of Western European countries, New Zealand and Australia.

In the European Union, in 2009, the official production of sheep meat and goat meat was accounted to 808 thousand tonnes and the import was accounted to 271 thousand tonnes, which it means a self-sufficiency of only 75.7% (table 6).

Table 6

**Supply balance – sheep meat and goat meat in EU**

(Source: European Commission, 2010)

	1 000 t			
	2006 ( <sup>(1)</sup> )	2007	2008	2009 ( <sup>(5)</sup> )
1	2	3	4	5
Gross internal production	1 038	1 097	1 027	804
Imports - live animals ( <sup>(1)</sup> )	10.5	0.0	0.0	0.0
Exports - live animals ( <sup>(1)</sup> )	1.4	4.4	3.0	3.7
Intra-EU trade ( <sup>(1)</sup> )	.	.	.	.
Net production	1 034	1 101	1 030	808
Change in stocks	.	.	.	.
Imports ( <sup>(2)</sup> )	280	272	270	271
Exports ( <sup>(2)</sup> )	3.5	5.9	5.6	7.9
Intra-EU trade ( <sup>(3)</sup> )	.	.	.	.
Internal use	1 315	1 362	1 291	1 067
Gross consumption (kg/head/year)	2.9	2.8	2.6	2.1
Self-sufficiency (%)	78.6	80.8	79.8	75.7

(1) Carcass weight; (2) Carcass weight - All trade with the exception of live animals; (3) All trade in carcass weight, with the exception of live animals (figures based on imports); (4) EU-25; (5) Official production only

As regards EU imports, New Zealand is by far the main (84%) origin of sheep meat followed by Australia (8%) and (to a lower extent) Argentina, Chile and Uruguay (around 2% each). Concerning the meat production trend in EU, there is a slight continuous decrease since 2007 which is likely to be continued to 2010. However, the

sheep and goat meat supply picture remains relatively stable. Gross consumption (kg/head/year) of sheep meat and goat meat in EU it was by 2.1 kg in 2009, which it is in decreasing comparing with previous years and close to the average consumption in the world (1.9 kg).

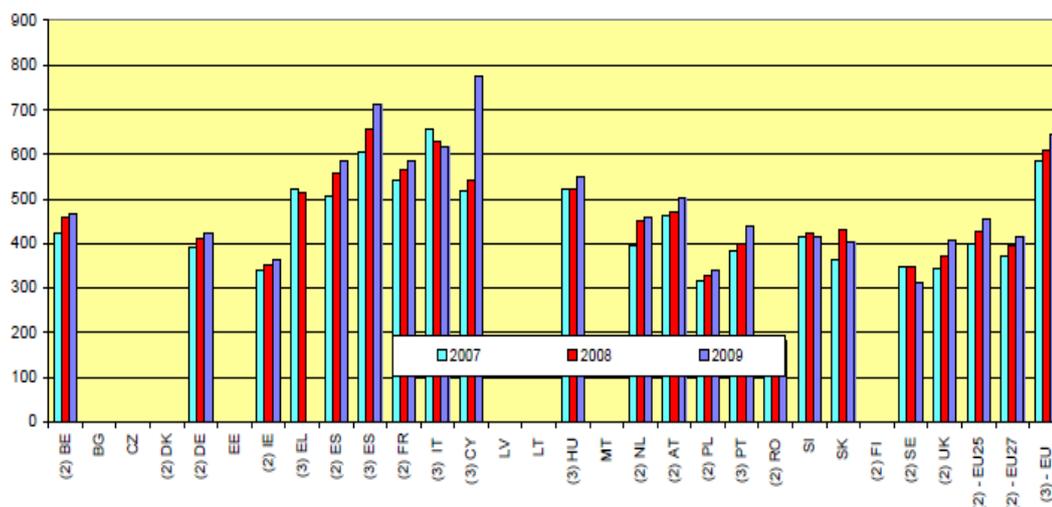
Regarding the prices of sheep meat (table 7 and figure 1) are set according to carcass weight and quality, thus different from one country to another (Ex. 412 euro/100 kg heavy lamb carcass in Germany, 575 euro/100 kg heavy lamb carcass and 656 euro/100 kg light lamb carcass in Spain, 563 euro/100 kg heavy lamb carcass in France, 514 euro/100 kg light lamb carcass in Greece, 371 euro/100 kg heavy lamb carcass in United Kingdom, 629 euro/100 kg light lamb carcass in Italy, 181 euro/100 kg heavy lamb carcass in Romania, etc.). The average price in EU is 417 euro/100 kg heavy lamb carcass and 643 euro/100 kg light lamb carcass.

Table 7

**Market prices for sheep meat in EU**  
(Source: European Commission, 2010)

	EUR/100kg <sup>(1)</sup>			
	2006	2007	2008	2009
1	2	3	4	5
Belgique/België (*)	392.18	424.97	460.83	464.31
Bulgaria	:	:	:	:
Česká republika	:	:	:	:
Danmark (*)	:	:	:	:
Deutschland (*)	407.63	391.00	412.56	423.90
Eesti	:	:	:	:
Éire/Ireland (*)	332.30	339.68	352.79	363.32
Elláda (*)	557.00	521.72	514.75	:
España (*)	478.38	504.48	558.71	582.80
España (*)	604.95	606.32	657.82	712.17
France (*)	543.06	540.14	563.45	584.12
Italia (*)	664.51	655.41	628.61	617.05
Kýpros (*)	589.68	517.06	539.34	774.38
Latvija	:	:	:	:
Lietuva	:	:	:	:
Magyarország (*)	546.91	521.70	520.57	550.43
Malta	:	:	:	:
Nederland (*)	403.43	395.47	450.84	457.50
Österreich (*)	464.58	463.37	469.62	502.74
Polska (*)	331.12	317.04	326.64	338.71
Portugal (*)	437.52	383.68	396.87	439.21
România (*)	:	180.79	188.37	181.53
Slovenija	:	413.70	421.65	414.60
Slovensko	:	362.88	430.68	402.96
Suomi/Finland (*)	:	:	:	:
Sverige (*)	339.99	346.97	349.33	309.68
United Kingdom (*)	376.04	344.93	371.80	406.26
EU25-Heavy lamb	416.04	400.36	427.45	453.00
EU27-Heavy lamb	416.04	371.49	396.01	417.30
EU-Light lamb	594.62	586.31	607.33	643.44

(1) Slaughter weight - (2) Heavy lamb - (3) Light lamb.



(1) Slaughter weight - (2) Heavy lamb - (3) Light lamb.

Figure 1. Market prices for sheep meat in EU (EUR/100kg) (1)

### 3. CONCLUSIONS

1. World production of meat in 2009 was 283,887 thousand tonnes of which 8,240 thousand tonnes is sheep meat, i.e. 2.9% of the total. Sheep meat production worldwide has increased continuously, reaching to be with 7.5% higher in 2009 than in 2000.

2. The average carcass of sheep worldwide in 2009 was 15.6 kg, being relatively stable in the period 2000-2009. The hardest carcasses are obtained in the North American continent (28.7 kg) and Oceania (19.2 kg) and on other continents is almost similar to the world average (15.6 kg).

3. In the European Union, in 2009, the official production of sheep meat and goat meat was accounted to 808 thousand tonnes and the import was accounted to 271 thousand tonnes, which it means a self-sufficiency of only 75.7%. The EU number of sheep slaughtered decreased (-24.6%) from 2000 to 2009 and is expected to decrease slightly in the near future. The average price for sheep meat in EU is 417 euro/100 kg heavy lamb carcass and 643 euro/100 kg light lamb carcass.

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## **HUMAN-BEING - ANIMAL RELATIONSHIP , A PECULIAR AGRO-TOURISTIC PRODUCT OF CONTEMPORANY URBAN DEMAND , BUT AT THE SAME TIME A DOMINANT ONE FOR THE FUTURE DECADES**

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**Key words:** agro-tourism, domestication, ethological traits.

### **SUMMARY**

The paper is based on animals breeders village transformation into a concentrate area of agro-touristic offer structured upon a touristic product which gathers ever more substance, synthetically delimited by the human-being–animal relationship. In the introductive part, it is emphasized the importance of human being–nimal relationship for the survival of Romanian village within the touristic area of the future. In the section concerning the material and the research method, after a short presentation of the etholgy impact on defining the new touristic product, there are described two types of thematical approaches, one based on classical investigation and the other one of comparison by investigating the open sources of modern data, such as the internet. The results and conclusions sections show that even if there is great availability and a remarkable potential, touristic services related to human-being–animal relationship in the Romanian agro-tourism, this one dpoesn't show yet the increase trends specific to the international market.

### **1. INTRODUCTION<sup>1</sup>**

No one can ever imagine how the human species would have lived or would have looked without their connections with the other Earth inhabitants: the animals with their way of behaving in different manners, like friends or helping hands, like stated enemies or behaving neutrally or apparently inofenssive, the same way as nobody can look towards the future of agro-tourism without investigating the same relationships. On the other hand, it is outlined the way human has betrayed his initial relationship with the animals and turned the balance given simultaneously by animals friendship and adversity into subsistence reasons, having as starting point the hunting and fishing, but killing much more than it was necessary for his food. Human activities past tried to individualize animals according to their specificity and then to regroup them according to resemblances, phenomenon which doesn't seem to be finished yet, although a part of the animals are already extincted or are endangered. The varied animal world has needed and still needs ever more classifications, rigorous and exact ones, which have as basis seven animals levels or groups, starting with the kingdom, type or filum, claa, order, family, gender, and finally, species. There are also a lot of animals life aspects which aren't known adequately, others which aren't treated sufficiently, aspects which remain still obscure and which hardly will be established with a certain degree of certitude. The

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touristic impact of human-animal relationship in the rural environment is one of the aspects which weren't treated very often, but which seems to deserve an ever increased attention. The human being has been evolving during the times, and his relationships with the animal world in the rural areas were very complex and complicated at the same time. The peasant and his rural community also recorded great victories, domesticating a series of useful animals (cow, sheep, horse, poultry, etc.) and obtaining loyal friends and undisputable aids (dog, cat, etc.), valorizing a series of products with big nutritive value (meat, milk, eggs, etc), some of them obtained by hunting wild animals or by slaughtering domestic animals, but also defeats, triggering an important number of natural enemies among animals (rodents, reptiles, insects), in an useless way and mostly as a consequence of a partial comprehension of the complex involvements of his agricultural or minor industrial activities, etc. The peasant oscillated between the protection of some useful animals, dear to him and the fight against some of them, like pests or parasites, taking correct and false decisions at the same time, as naturally, as normally is. Human-animal relationship was an essential one for the survival but also one of education for the humans in the community and nowadays, it becomes even a touristic product. Mainly, the rural agro-tourism offer comprises a single service on the global tourist market. This is the way of forming or reforming the human behaviour of gentleness docility in front of the animal (having a lost equivalent in the words "handling"-to run, to manage, to handle cautiously or "gentling" sweetness, gentleness, friendship, which were used in anglo-saxon rural classical economies, also disappeared in the darkness of the history). This kind of tourist products may be specially quoted, sending to the old signification of the terms (*handling* referred to catching the animals which were free, their introduction into cages and their transport, and *gentling* represented to offer the comfort by an adequate feeding and caring, according to the pleasure requests of the animal. At the same time, one cannot observe or quantify exactly the animal state, considered as pleasure or as unpleasant state or unbearable one. The speciality research demonstrated the truth according to which human behaviour, of *gentling* kind has exception effects in the human-animal relationship (*gentling* was used for sheep as a possible method of reduction of the offensive state of animals within different treatments and after only 35 days it substantially reduced the contact distance like the cardiac answers to human getting close). The living together has also gentling effect. Generally, the sheep present strong aversion reactions to canines, but if they were reared and accustomed with a guardian dog, they won't be affected at all. Between human and animal among animals species, there can be found only two key-words: fear and sociability, which aren't really opposite. The research concerning the animals fear behaviour, such as cattle, sheep or domesticated poultry go together to the notion of individual variability of genetical origin. In this respect, the peasant may select the best animals or the best adapted animals to the rearing condition, created by man, this way cultivating the sociability for the tourist. The animal species diversity, their internal variability, their spreading in the geographical area, the colour spreading according to the seasons, to the day moments or to the travel, when the visual and sound contact with the animal occurs, become essential for the tourist, this one entering again an occupational traditional circuit, longtime forgotten, or safe and sound never known. The

*ethological* traits are essential within the new tourist product, because these ones refer to certain peculiarities, differentiated on species and which refer to the appearance of some changes in the animals behaviour, changes which especially appear in the reproductive one (partners attraction or rejection), including *the social relationship*. Generally, these peculiarities also refer to the way of getting the food, showing specific auxiliary behaviours, typical for this phenomenon, towards which the animal cannot manifest outwardly those acts of search-see, receiving the feed in troughs upon balanced ratios. Ethology recreated the desire of escaping from the urban confinement, the tourist enters in contact with the animal, regathering the desire of spacial conquering, of move freedom, lost in the city ultra-fast means of transport. Found in the rural area, the tourist comes back to the ever friends of humans, domesticated during long periods of time, in order to be used as traditional means of transport, as food or safe and sound as friends and guardians of the human being and property. The present work tries to identify some of the extended valorization solutions of the touristic product, which this paper defines to be as human-animal relationship, the perspectives in the future of agro-tourism but also some of the possible threats in the areas of Romanian rural localities, recognized by animals breeding and which became national agro-touristic attraction point.

## 2. MATERIAL AND METHOD

Within animals domestication, there were tried many explanations, starting from the economic ones to the occupational traditional ones, some of them credible enough, others less integrative, some of them really true and long-lasting, others more successful but with a more reduced availability. An explanation estimated as important based on religious reasons seems to be closer to the morals and faiths of the Romanian traditional village, but the most important part of the researchers think that the main motivation of animals domestication derives from the living way from the prehistoric times or from the origins of humankind. Domestication is a process which unfolded during thousands of years, to which whole generations of people participated in. Thus, there were suggested more stages: *captivity, taming and the proper domestication*. Having the food assured, animals domestication played an important role in the afterward human's evolution, by means of which his work was facilitated and he started to have other preoccupations too using animals in order to obtain some other products (milk, eggs, etc.) or for different works. This, domestication is a process which never stopped, extending also over the ones partially present in the agro-touristic farm or in the peasant's household. *Among the characteristics of behaviour favourable to the domestication process one can mention:* a) social groups structure (large social groups, leader and hierarchical structure, males associated to females groups); b) sexual behaviour (random mating, males dominance over females, sexual signals by movements and positions); c) mother-product relationship (strangers adoption, little time after parturition, or hatching, critical period of getting closer, youth precocity); d) the answer to the human (short distance, running, the weak reaction to the human); e) other characteristics (omnivorous, adjustment to the environmental conditions, limited ability). Among the unfavourable ones, the aspects related to the structures of territory type and to the males presence inside of the group, to

limited matings, to markings or morphological traits with sexual impact, to establishing connections based on species characteristics m to adoption only according specific characteristics, to the youth, weakly developed when being given birth, to mistrust and possibilities amaged by human being and environmental alterations, food diet, extreme ability, etc. (Hale, 1969). The research geographical area was represented by "Mărginimea Sibiului", an original area which is located within a quadrilateral, whoselimits are, at the edge of Sibiu Mountains, the gorge Turnu Roșu, Șelimbăr and Cărpiniș villages (both located in Sibiu county) and the Tărtărau Peak, respectively an area formed of a region with depressions and (to the height of 650 m.) and of a mountain area (which reaches the height of 2245 m). The method used within the research was the one of comparing the exhaustive investigation generated by the boarding-houses survey's investigation from Sibiu county, with the data from the boarding-houses identified on the internet, in "Mărginimea Sibiului", as well as of the structural changes of comparison during one year period. Within the investigation, of the boarding-houses in Sibiu county, there was elaborated a question form by means of which an investigation took place, in boarding-houses from the analysed area. The interviewers were 8 people, who were choosen by volunteering among the students of the Mountain Specialization of the Agriculture, Food Industry and Environmental Protection School of *Lucian Blaga University*. In order to identify and to compare the temporal tendencies, the information connected to the boarding houses located also in "Mărginimea Sibiului", emphasizes the double influence of rural and urban tradition within the touristic services connected to the human-animal relationship.

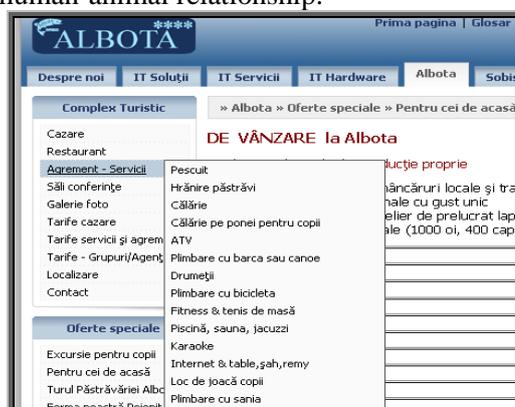


Figure no.1 Example of touristic services accessing

Source: [http://www.turistclub.ro/complex-turistic-pastravaria-albota\\_6183.htm](http://www.turistclub.ro/complex-turistic-pastravaria-albota_6183.htm).

Boarding-houses investigation bases on the data source of the internet extracted the comparison data by accessing services packs described on the boarding-houses sites.

The investigation interest was the one of identifying the services related to the human-animal relationship and their trends in trimre. An example touristic services is described, as follows: "In Poienița boarding-house , in a natural and ecological landscape, you canb visit and observe : shepherdsand oursheep flock, Carpathia goats with heir cubs, Bazna and Landrace pigs, *Bălțată Românească* cows herd, Romanian

buffaloes (from Șercaia). Horses for riding etc. Would you like to have an active and archaic holiday ? The tourists who still dream of the rhythm of an original lifeway become in an instant shepherds, goats guardian, shepherd wife who milks and prepares cheese and polenta or they may assist to the evening milking of the cows /sheep during the intervals 17.00-19.00 and they may sleep for one night in the hay above the horses stables or in the hay barn from the valley under the lights of the Moon and of the stars.” . In the area of reception, informing and documentation there are meetings among horse friends and passionate. There are not only area for horse riding but for working and horses keeping 3 stables and 2 fields. The touristic services consist in : free air training, round manage, horse-riding initiation, and horses pavilion, namely “La Botul Calului” (for seeing these wonderful animals)

### 3. RESULTS AND DISCUSSIONS

From the processing and analysis of 46 question forms filled in , on the field , one can see the following results :

- 70% from the analysed touristic structures make part from the category of rural touristic boarding-houses,; 26% are agro-touristical , respectively the owners make also agricultural activities; 2 % is framed within the villa category and 2% in the hostel category .
- The touristic structures where the investigation took place are: from Sibiel, Sadu, Rășinari, Râul Sadului and Cîrțișoara.
- 65% from the analysed touristic structures are framed in the category of 3 stars, 26% in 2 stars, 4% in 4 stars , 2% in 5 stars and 2% in a star.
- The checking in capacity is for 48% of these of about 10 places , in 26% , it is comprised between 11 and 20 places , 13% from the touristic structures have between 21 – 30 places and 13 % have more than 30 places.
- The average degree of occupation is of about 90% in the summer and 30 % during the rest of the year.
- The agro-touristic boarding-houses offer also food services exclusively for the tourists checked in, exceptions making Sibiel locality, where most of the boarding-houses organize traditional feasts for the tourists in the locality
- Only in 38% from the analysed structures , there was found employed and qualified staff ( receptionist, chef, maids) , in the other ones , the activities being made by the owners family.
- The medium period of voyage is of 3-4 days for agro-touristic boarding-houses and 2-3 days for the other ones. .
- From the specific improvements for spending free time , one can remark, places for children play, pools, massage, sauna, tennis, riding, fishing, billiards, sports field, darts, barbecue place, carriage transport etc.
- Under 15 % have animals in the area which is at tourists disposal, respectively stables for animals or paddocks for riding ( about 10%).
- All touristic boarding-houses have parking-places , 13% being supplied with an access platform for people with disabilities.

- Among the additional services offered to the tourists , with or without payment, we mention: organizing feasts (69%), menu dietetic (7%), touristic guide (20%), trading hygiene products, hand-made products , etc. (5 %).
- The payment ways for the offered services are :card pay (41%), promissory note pay, cheque or pay order (34%), voucher (10%).
- The practiced tariffs are of: 50 - 70 de lei for single, 70–100 lei for double room, apartments between 50–180 lei and matrimonial room 70-80 lei.
- Concerning the medium age of tourists, 66 % of these are aged between 31 -50 years, 28 % are under 30 and 6% are elder than 51.
- although the boarding-houses don't state in the ¼ report that they owe animals farm , one acknowledges that the food offered to the tourists comes in proportion of 24 % from the produces made in a peasant household, only the rest being bought. In all the analysed touristic structures, at customers demand, there are organized different events( festive meals, anniversary meals, weddings, baptizings, parties, traditional receiving courses, team-building etc. )
- 45% from the analysed touristic structures work as independent, 21% are affiliate to the Cultural, Ecological and Rural National Association of Tourism, 3% to Romanian Association for Ecological Tourism and Checking BED & BREAKFAST, 3% TO THE TOUR-OPERATORS in Romania, 10% to the Tourism Press Club –FIJET Romania and 21% are affiliated to some Local Tourism Associations. The investigation achieved by means of the internet allowed the statistic necessary evaluation and comparison .The information concerning the tariffs are considered to be medium, the same parking places and checking in places. But the services based on the relationship human-animal are different in a significant manner. Among the 51 touristic boarding-houses present on the internet in the area of the *Mărginimii Sibiului*, only 5 describe touristic services related to the human-animal relationship, this meaning that they put at the tourists disposal these services. Among these, only 3, offer riding services, which shows that the dynamics is lowering in the heart of the *area Mărginimea Sibiului*, respectively under 10% owe farms and about 6% offer riding services in an area where the relationship between human and animal lasts for centuries.

#### 4. CONCLUSIONS

The human interventions in animals life didn't remain resultless, contributing to the creation of some fundamental differences between the domestic and wild animals, whom the tourist may acknowledge and appreciate. These changes may be grouped in morphological and physiological ones. Hence, the extreme fear of some tourists of some domesticated animals, considered personally in a false way, wild ones. *Morphological changes* refers to the body shape and structure , skeleton, skin, etc. All these aspects become attractions of the species, in report with the stated touristic intention to revive some lost attitudes or to look for some explanations in the unconscious of the tamer who is the human being. *The tourist may come back to childhood or may become a child during a voyage. The touristic curiosity reopens in the rural environment for this universe of animals.* Physiological changes being examples of some significant changes in the food valorization capacity, reproductive cycle changes, productive aptitudes changes, etc.

Behaviour changes in animals are related to the adjustment way to the rearing condition. In a reflexive and retrospective manner, the tourist debates upon some partially lost abilities. His dialogue and behaviour will undertake changes in comparison with the responsibility and dominance over the animal. Almost all the positive aspects in the relationship human-animal originates from the economic principle, source, economic-active, productive or other activities generator principle.(transport etc.) Certain negative effects of existant relationships between human and animal, are related to the fact that that the farmer and the owner of the agro-touristic boarding-house may induce the fear reaction only by their simple presence, and within this context, it appears a double interest, one related to the phenomenon analysis as person, and other related to the evaluation in the field and the efficacy of the keeping-rearing system efficacy. The human-animal allows the estimation of the level fright-fear show by the animal, in front of the human being. The touristic involvement of this connexion doesn't reach alarming quotas in the rural areas, where the peasant comes closer by soul to the animals from his own household, the friendship getting in time reciprocity. There are some solutions of escaping from fear by maternal substitution methods. A young animal, even when it is fed, and the natural feeding is replaced by the artificial one, it is obviously lost a part of the fear in front of the human being. The tourist may live a special feeling by his involvements in the fear management processes, and his coming back to the agro-touristic environment will become a certitude, easily to evaluate. Still during this period, there can be made interspecific connections which may seem as printed (these situations may lead even to a more important familiarity of animals or on the contrary to behaviour troubles, where a series of accidents, especially with big animals may occur, like the bulls reared isolated which become more aggressive in front of the human, in comparison with the ones reared in collectivity).

The multitude of maintaining ways and the choice of one which damages the animal reaction towards some constraints which may affect the relationship human-animal. Only an innovatory programme based also on services originated from the human-animal relationship may be considered a balanced one and able to preserve the traditional occupations and the products of these ones relate to animal husbandry, and may reoffer originality to Romanian lands.

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## STUDY OF THE INCUBATION PARAMETERS IN THE "BALOTEȘTI" QUAILS POPULATION

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**Key words** : quail, incubation, temperature, humidity

### SUMMARY

The research purpose was to determine the results of incubation for the Balotești quails' population in case of small surface incubators and to determine the optimal temperature and humidity during hatching and some measures to improve results of incubation. For this, incubation results in a total of 2700 hatching eggs, divided into six lots and three experiments were studied.

The highest hatching percentage (66.22%) was recorded for experiment E2, the temperature ranged from 38.0 - 38.5 ° C during 0-14 days and between 37.7 - 38.2 ° C during 15 -17 days and humidity ranged from 50-55% during 0-14 days and between 65-70% from 15 to 17 days. Good results were obtained at temperatures between 37.5 ° C and 38.0 ° C in the incubation period and 37.2 ° C - 37.7 ° during hatching.

### 1. MATERIAL AND METHOD

The research was conducted on a total of 2700 quail eggs for hatching of the population "Balotești". Three experiments were held (labeled E1, E2 and E3) on six batches of 150 eggs each. To establish the optimal temperature and humidity during hatching quail eggs 3 levels of temperature and humidity were used, respectively high temperature (38.5 ° C - 39.0 ° C during 0-14 days and 38.2 ° C - 38.7 ° from 15 to 17 days if the experiment E1), average temperature (38.0 ° C - 38.5 ° C during 0 -14 days and 37.7 ° C - 38.2 ° during 15 to 17 days if the experiment E2) and low temperature (37.5 ° C - 38.0 ° C during 0 -14 days and 37.2 ° C - 37.7 and between 15 to 17 days if the experiment E3). They also used three levels of humidity, i.e. low humidity (45% - 50% RH, from 0 -14 days and 60-65% between 15 to 17 days if the experiment E1), average humidity ( 50-55% RH between 0 -14 days and 65-70% between 15 to 17 days if the experiment E2) and high humidity (55% - 60% RH between 0 and 70 -14 days -75% between 15 to 17 days if the experiment E3).

In the experiment six incubators type surface Cleo 5 were used. The temperature was measured in each incubator with digital thermometers, while the average humidity was controlled by hygrometers installed in each incubator. Experiments were conducted in Individual Enterprise IONIȚĂ T. LUCIAN Bucharest the working point located in the Gherghița commune, Ungureni village, Prahova County. An average temperature and humidity for each lot for each day of incubation was recorded. Returning the eggs took place twice a day along the longitudinal axis at an angle of 180°. Weightings were made to control the survey method in 50 eggs (33%) per group on day 1 of incubation, day 3 of incubation, day 5 of incubation, incubation day 7, day 10 of incubation and day 15 of

incubation. It was determined the average weight of chicks at the age of 1 day by individual weighing 20 chicks per lot. Data processing was performed using Microsoft Excel 2003, and for testing differences in media analysis of variance was performed separately for each repetition and for each determination in part. The variance analysis was used followed by Fisher test Tukey test to see differences between the environments.

## 2. RESULTS AND DISCUSSIONS

### THE EVOLUTION OF AVERAGE EGG WEIGHT DURING THE INCUBATION IN THE 3 EXPERIMENTS

The egg weight during incubation in the 3 experiments are presented in the table 1 and the figure 1.

*Table 1*

#### The evolution of average egg weight during the incubation period

Specification	Experiment E1	Experiment E2	Experiment E3
The weight of the eggs introduced in the incubator, g	11.83 ± 0.14	11.23 ± 0.15	11.00 ± 0.25
The weight of the eggs after 3 days of incubation, g	10.99 ± 0.28	10.64 ± 0.18	10.66 ± 0.38
The egg loss weight after 3 days of incubation, %	7.11 %	5.27 %	3.12 %
The weight of the egg after 5 incubation days, g	10.57 ± 0.12	9.95 ± 0.29	10.29 ± 0.22
The egg loss weight after 5 days of incubation, % (3 – 5 days)	3.59 %	6.15 %	3.33 %
The weight of the egg after 7 incubation days, g	10.29 ± 0.19	9.72 ± 0.29	10.04 ± 0.22
The egg loss weight after 7 days of incubation, (5 – 7 days) %	2.32 %	2.07 %	2.27 %
The weight of the egg after 10 incubation days, g	10.03 ± 0.16	9.55 ± 0.26	9.77 ± 0.13
The egg loss weight after 10 days of incubation, (7 – 10 days) %	2.18 %	1.48 %	2.42 %
The weight of the egg after 15 incubation days, g	9.77 ± 0.16	9.37 ± 0.25	9.59 ± 0.16
The egg loss weight after 15 days of incubation, (10-15 days) %	2.18 %	1.56 %	1.67 %
The total egg loss weight of incubation, % (0- 15 days)	17.39 %	16.54 %	12.8 %

If the experiment E1 (Table 1 and Fig. 1), from an average weight of hatching eggs at the beginning of 11.83 ± 0.14 g, reached on the 15th day of incubation to an

average weight of eggs of  $9.77 \pm 0.16$  g, total weight loss during the first 15 days of incubation was 2.06 g/ egg, respectively 17.39% of initial average weight of eggs. The highest percentage of weight loss during the first 15 days of incubation was recorded by day 3 of incubation (7.11%), water loss from 3 - 5 days being 3.59%, by day 7 was of 2.32%. Between 7-10 days weight loss was 2.18% and 2.18% by 10-15 days.

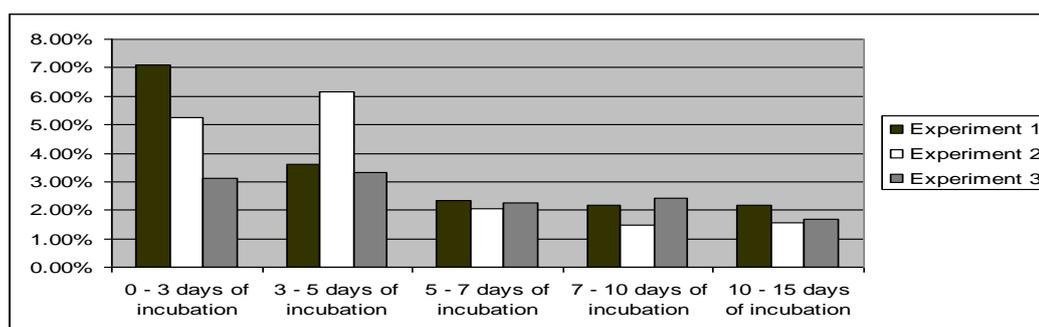


Fig. 1: The evolution of average eggs weight loss during the 15 days of incubation at the egg of the 3 experiments

If the experiment E2 (table 1 and fig. 1), from an average weight of hatching eggs at the beginning of  $11.23 \pm 0.15$  g, reached the 15th day of incubation to an average weight of  $9.37 \pm 0.25$  eggs g, total weight loss during the first 15 days of incubation was 1.86 g/ egg, respectively 16.54% of initial average weight of eggs. The highest percentage of weight loss during the first 15 days of incubation was recorded during 3-5 days of incubation (6.15%), water loss by day 3 being 5.27% between 3-7 days being of 2.07%. Between days 7-10 weight loss was 1.48% and between 10-15 days was of 1.56%.

In the experiment E3 (Table 1 and Fig. 1), from an average weight of hatching eggs at the beginning of  $11.00 \pm 0.25$  g, reached the 15th day of incubation to an average weight of  $9.59 \pm 0.16$  eggs g, total weight loss during the first 15 days of incubation was 1.41 g/ egg, respectively 12.80% of initial average weight of eggs. The highest percentage of weight loss during the first 15 days of incubation was recorded on day 5 of incubation (3.33%), water loss by day 3 being 3.12%, during 5-7 days being 2.27%. Between days 7-10 of incubation the weight loss was of 2.42% and between 10-15 days it was of 1.48%.

#### THE INCUBATION RESULTS FOR THE 3 EXPERIMENTS

The incubation results at the 3 experiments are presented in the table 2 and figure 2.

In the experiment E1 the lowest hatching percentage (52.50%) was recorded. The average weight of chick at the age of 1 day of  $8.47$  was  $0.11$  g  $\pm$ , and recorded the highest percentage of initial weight of the chick weight (72.17%). The proportion of dead in shell chicks was highest for experiment E1 (21.22%), percentage of clear eggs and dried eggs

were also highest (19.77% and 6.44%). Egg shell weight after hatching was 11.52% of initial weight of the egg.

Table 2

### The incubation results at the 3 experiments

Specification	Experiment E1	Experiment E2	Experiment E3
Average hatching percent, %	52.50	66.22	64.67
Average chick weight at the 1 day of age (g)	8.47 ± 0.11	7.78 ± 0.06	8.62 ± 0.11
The proportion of chick weight from the initial egg weight, %	72.17	65.17	70.91
Egg with dead chick in the shell, %	21.22	16.89	16.89
Clear eggs, %	19.77	15.67	16.22
Dried eggs,%	6.44	1.22	2.22
The weight egg loss during the incubation period (days 1-15) %	16.46	17.16	12.79
The shell weight after the end of hatching, g	1.126 ± 0.11	0.978 ± 0.09	1.069 ± 0.11
The shell proportion after the hatching process, %	11.52	10.44	11.15

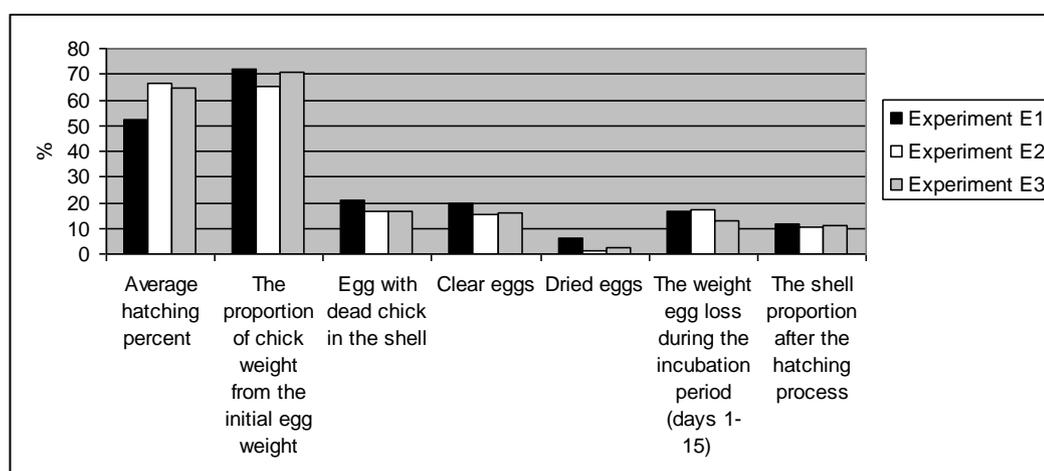


Fig. 2. The average results obtained at the egg quail incubation of the 3 experiments

In the experiment E2 (Table 2 and Fig. 2) the highest hatching percentage (66.22%) was recorded. The average weight of chick at the age of day 1 was  $7.78 \pm 0.06$  g and the weight of the chick weight initial weight was 65.17%. The percentage of dead in shell chicken eggs was 16.89%, the percentage of clear eggs was of 15.67 % and dried

eggs were of 1.22%. Egg shell weight after hatching was 10.44% of initial weight of the egg.

In the experiment E3 (Table 2 and Fig. 2) a hatching percentage of 64.67% was obtained. The average weight of chicken at the age of 1 day was  $8.62 \pm 0.11$  and the percentage of the initial chick weight was 70.19%. The proportion of dead in shell chicken eggs was 16.89%, for the clear eggs it was 16.22 % and for dried egg it was 2.22%. Egg shell weight after hatching was 11.15% of the initial weight of the egg.

The results determined in these experiments are similar to those established by Romao J. M. et al. (2009, Brazil) which aimed to determine the effect of relative humidity in the incubator of the eggs hatching performance of quail. To achieve this, the eggs were incubated at three different values of relative humidity: 36% (low humidity), 52% (average humidity) and 77% (high humidity). Temperature during incubation of the three groups was 37.5° C and returning of the eggs was performed every 30 minutes. Eggs incubated at low humidity had the largest weight loss (11.96%), while eggs incubated at high humidity showed the smallest weight loss during incubation (4.89%). Chick weight ratio at 1 day old and initial weight of the egg before placing in the incubation was highest for the batch of eggs incubated at high humidity (74.25%) compared with the other two groups (70% and 71.88%).

Also, Pedroso et al. (2006) recorded the hatching percentage of 77.85% and 75.28% for eggs incubated at 55% and 65% relative humidity. Regarding the position and returning of eggs, Moraes T.G.V. and Romao J.M. (2009, Brazil) have established that the best position is horizontal along the horizontal axis using a 180° angle, position used also in this experiment. Soliman et al. (1994) showed a weight loss of 11.32% of the egg in Japanese quail eggs incubated at a temperature of 37.5° C and a relative humidity of 56% and also, they claim that mortality in the first part of hatching is the result of excessive weight loss of eggs.

### 3. CONCLUSIONS

After analyzing the results it can be affirmed that during 0-14 days of incubation the recommended temperature to ensure the best incubation results for surface quails incubators is between 38.0° C and 38.5° C during the incubation and 37.7 and C - 38.2° during hatching (experiment E2). Good results were obtained at temperatures between 37.5° C and 38.0° C in the incubation period and 37.2 ° C - 37.7 ° during hatching (experiment E3). The humidity should be 50 - 55% RH in the incubation period and 65-70% during hatching (experiment E2). Good results were obtained for higher humidity too (55% - 60% RH in the incubation period and 70-75% in the period of hatching, during the experiment E1).

Higher temperatures (38.00° - 39.5° C) tend to shorten the period of hatching, chicks starting hatching from day 15 and the majority of chicks hatching takes place on the 16th and 17th days of incubation. Also, the use of temperatures below 38 ° C during 0-17 days of incubation leads to a smaller proportion of chicken embryos dead in shell, as well as lower proportions of weight loss of eggs during incubation.

It is possible that the use of temperatures above 38° C during 0-17 days of incubation to lead to a greater weight of the offspring at age 1 day. Given the relatively high proportion of dead chick eggs in shell in each of the three experiments it is important to establish the cause of this mortality and the possibility of reducing it, because, although embryonic development occurs, there is a high percentage of mortality during the hatching. A cause could be insufficient humidifiers, especially in early hatching.

Another possibility to increase the percentage of hatching would be to improve ventilation of the incubator system, especially during hatching, by increasing the rate of incubation, since the need for oxygen and carbon dioxide production increase as incubation advancement. To improve knowledge and performance in incubation quails in this type of incubator is necessary to continue the research in this regard.

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## **RESEARCHES ABOUT INFLUENCE OF FEED PARAMETERS ON SLAUGHTERING PERFORMANCES IN BIO CHICKENS**

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**Key words:** Bio chickens, carcass, output, performance.

### **SUMMARY**

Technically and commercially carcass quality is determined by carcass size (weight, output, percentage of body parts) and carcass conformation (muscle profiles, fat presence, etc.).

Experiments were performed at S.D.E. Avicola Moara Domnească with 150 broilers type Bio of Plymouth Rock race divided in three treatments based of nutritive value of combined feed given (ME, E1, E2). Experimental period had 84 days same as in production technology of ecological chicks. Data that was obtained during the experiment were processed and so it was noticed that best slaughtering results (commercial output, percentages of breast and legs from carcass) were obtained in group E2 (receiving a combined feed with diminished energy level).

Broiler growth rate has very wide variations depending of genetically potential of hybrids, poultry sex and management conditions during production cycle. Feed quality and especially feed protein and essential amino acids content are paramount for phenotypical expression of genetically potential. An efficient understanding of nutritional limitations for poultry production concerning commonly used feed sources is a key to improving feed processing and nutritional strategies and a base for solving many problems with feed composition, consumption and usage and with carcass quality.

Some values of carcass output and a percentage of body parts in carcass were determined to establish slaughtering performances in experimental strains.

### **1. MATERIAL AND METHOD**

Experiment was performed at S.D.E. Avicola Moara Domnească at the experimental farm of University of Agricultural Sciences and Veterinary Medicine Bucharest with Bio broilers in three experimental pens with uniform body weight and sex proportions by using experimental plan in blocks. Plymouth Rock lined chicks were used in this experiment and they were raised according to standard technology for this strain in same management, feeding and watering conditions.

Three treatments were performed for each experimental group to determine quantitative and qualitative characters and experiment were performed during the same time period and with same biological material and in the same house.

This was the working schedule developed for Bio broilers:

- treatment I (M): constant energy level and constant protein level;
- treatment II (E<sub>1</sub>): variable protein level and constant energy level;
- treatment III (E<sub>2</sub>): constant protein level and variable energy level;

5 groups of 10 heads each were used by treatment in all three experiments (table 1).

Groups were formed by day old chicks from same hatchery and from parents of same age to minimize genetic influence on results. Experimental period was 84 days using two phases feeding technology. Milled feed used in experiments was produced in I.B.N.A. – Balotești according to nutrient requirement of chicks used and based on the experimental schedule.

Performance parameters which were established and monitored weekly during the experiment for each treatment and group were as following: birds live weight, feed intake and livability.

Table 1

### Working schedule for Bio broiler

No.	Specification	M.U.	Phase					
			Production			Finishing		
			T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
1	Time	days	28	28	28	56	56	56
2	Flock	birds	50	50	50	50	50	50
3	Groups	nr.	5	5	5	5	5	5
4	ME	MJ/kg	100	100	93.46	100	100	92.90
5	Protein	%	100	95.00	100	100	94.51	100

25% of flock was slaughtered at 84 days of age to determine slaughtering performances and chicks were weight before slaughtering and chicks representative for average group weight were chosen for slaughtering.

After slaughtering chicks were plucked, weight cut and carcass weight, breast weight, legs weight, wings weight, internal organs weight and remaining carcass weight were determined by using the cervical dislocation technique.

## 2. RESULTS AND DISCUSSIONS

Slaughtering performances were established based on structure of used milled feeds and also based of final production performances which were obtained with Bio chicks in each experimental pen.

Final production performances of Bio chicks are showed in table 2 and figure 1. Bio are having an average live weight between 2496.14 g in group E1 and 2439.84 g in group E2 at 12 weeks of age with no influence of results by protein or energy variations and there are no statistically significant differences between results. EM group had also best specific consumption with constant protein and energy levels and E2 group had worst specific consumption with variable energy level between 3.34 – 3.52. All differences between groups are statistically significant. EM group had also best chick's livability (6.2 % mortality) and E2 had worst livability (10.4 % mortality) but differences were not statistically significant. In conclusion best production results for Bio chicks are those of group EM with a highly significantly smaller specific consumption compared to the other groups.

Table 2

## Final production performances in Bio chickens

No.	Specification	M.U.	Flock					
			E M		E 1		E 2	
			X	S <sub>x</sub>	X	S <sub>x</sub>	X	S <sub>x</sub>
1	Liveweight	g	2456.00	62.02	2496.14	69.12	2439.84	55.28
2	Student Test	-	ME-E1=0.305		E1-E2=0.451		E2-ME=0.137	
3	Average Daily gain	g	28.83	0.74	29.32	0.82	28.65	0.67
4	Student Test	-	ME-E1=0.312		E1-E2=0.453		E2-ME=0.128	
5	Specific intake	kg	3.34	0.01	3.42	0.01	3.52	0.01
6	Student Test	-	ME-E1=6.86		E1-E2=11.15		E2-ME=20.07	
7	Cumulative mortality	%	6.20	1.36	8.20	1.18	10.40	1.56
8	Student Test	-	ME-E1=0.247		E1-E2=0.269		E2-ME=0.472	

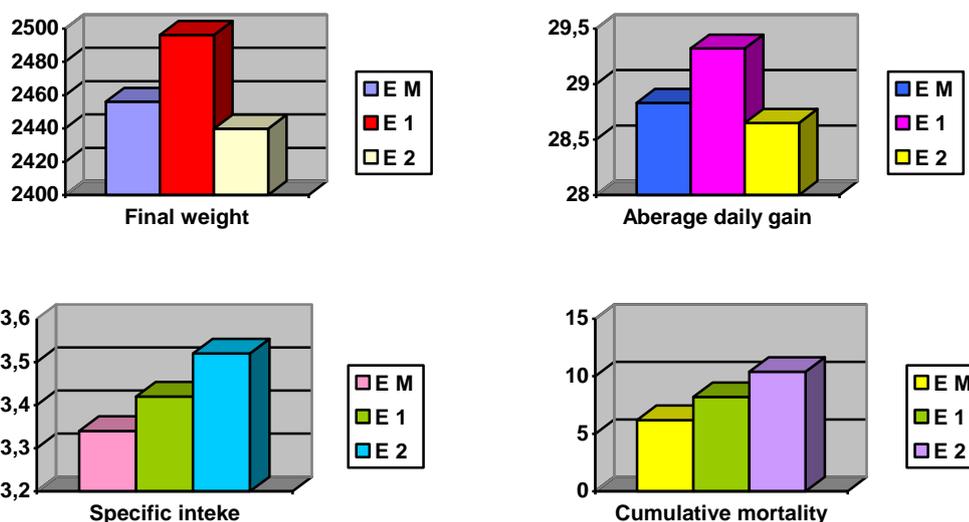


Figure 1. Final production performances in Bio chickens

Table 3 and figure 2 are showing quality indexes of meat for Bio chicks resulted from analyzed treatments. Analyze of data is showing different slaughtering performances based on analyzed treatment and studied index. Commercial efficiency is between  $79.70 \pm 0.65\%$  - in group EM and  $81.20 \pm 5.71\%$  - in group E2. Breast percentage is between  $20.80 \pm 0.53\%$  - in group E1 and  $21.40 \pm 1.13\%$  - in group E2. Legs percentage is between  $27.70 \pm 0.72\%$  - in group E2 and  $28.00 \pm 0.38\%$  - in group E2 and wings percentage is between  $1000 \pm 0.27\%$  - in group EM and  $10.50 \pm 0.32\%$  - in group E2.

Table 3

## Slaughtering performances in Bio chickens

No.	Specification		Flock					
			E M		E 1		E 2	
			X	S <sub>x</sub>	X	S <sub>x</sub>	X	S <sub>x</sub>
1	Output (%)		79.70	0.65	79.90	1.17	81.20	5.71
2	Breast percentage (%)	liveweight	16.9	0.29	16.7	0.62	17.2	1.11
		carcass	21.2	0.44	20.8	0.53	21.4	1.13
3	Legs percentage (%)	liveweight	22.3	0.46	22.2	0.47	22.6	1.98
		carcass	28.0	0.38	27.8	0.84	27.7	0.72
4	Wings percentage (%)	liveweight	7.9	0.21	8.2	0.51	8.6	0.83
		carcass	10.0	0.27	10.3	0.75	10.5	0.32
5	Head percentage (%)	liveweight	3.6	0.19	3.1	0.17	4.0	0.28
		carcass	4.5	0.21	4.0	0.26	4.9	0.15
6	Gizzard percentage (%)	liveweight	1.6	0.23	1.5	0.09	1.5	0.12
		carcass	2.1	0.30	1.8	0.10	1.9	0.09
7	Back percentage (%)	liveweight	21.9	0.29	22.6	1.51	21.6	1.79
		carcass	27.5	0.28	28.2	1.56	26.5	0.87
8	Hart percentage (%)	liveweight	0.4	0.02	0.5	0.05	0.5	0.03
		carcass	0.5	0.03	0.7	0.06	0.6	0.04
9	Liver percentage (%)	liveweight	1.9	0.09	2.0	0.27	1.8	0.14
		carcass	2.3	0.12	2.4	0.32	2.2	0.08
10	Tibial percentage (%)	liveweight	3.2	0.15	3.2	0.21	3.4	0.26
		carcass	4.0	0.17	4.0	0.30	4.3	0.36

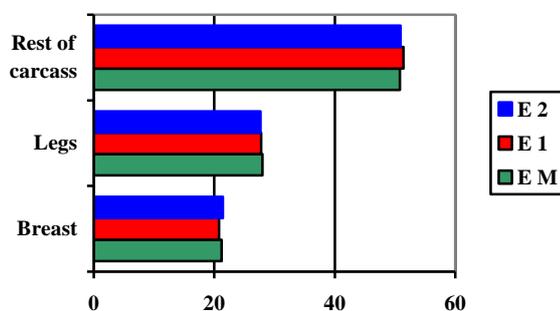


Figure 2. Percentage of different carcass components in Bio chickens

## 3. CONCLUSIONS

- final production performances are different by experimental group and usually best final production performances are in group ME with the exception of group E1 (body weight);
- commercial output was between  $79.70 \pm 0.65\%$  in ME and  $81.20 \pm 5.71\%$  in E2;
- highest breast percentage was noticed in group E2 ( $21.40 \pm 1.13\%$  from whole carcass) and highest leg percentage was noticed in group ME ( $28.00 \pm 0.38\%$ )

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## **RESEARCHES ABOUT INFLUENCE OF FEED PARAMETHERS ON SLAUGHTERING PERFORMANCES IN FREE-RANGE CHICKENS**

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**Key words:** Free-range chickens, carcass, output, performance.

### **SUMMARY**

Product quality standard is a base criterion for animal product consumers in their product selection. To establish the quality of carcasses data about slaughtering output, percentage of cuts from carcasses and percentage of main internal organs from carcasses were registered and processed both for live weight and carcasses.

Experiments were performed at S.D.E. Avicola Moara Domnească during 56 days with 150 Plymouth Rock chickens divided in three treatments based of nutritive value of combined feed given (FM, F1, F2). Data that was obtained during the experiment were processed and so it was noticed that best commercial output was obtained in group with constant nutritive parameters (FM) and best breast percentage from carcass was noticed in group with variable protein (F1) and best in leg percentage was noticed in group with variable energy (F2).

Carcass quality is a very complex and sensitive issue because it is dependent by possibility and techniques applied to determine value and also by many elements determining carcass parameters and also by interested group involved in food chain from producer to consumer.

In feed milling nutrient levels should be established based on both chicks need and financial circumstances and any variation of nutrient composition should be followed by a prompt answer in slaughtering performances leading to a competitive feed cost and so to a competitive final product cost with no change in chemical meat composition.

Some values about carcass output and percentage of body parts in carcass were determined for this purpose using feed combination with variable parameters.

### **1. MATERIAL AND METHOD**

Experiment was performed at S.D.E. Avicola Moara Domnească at the experimental farm of University of Agricultural Sciences and Veterinary Medicine Bucharest with Free-range broilers in three experimental pens with uniform body weight and sex proportions by using experimental plan in blocks. Plymouth Rock lined chicks were used in this experiment and they were raised according to standard technology for this strain in same management, feeding and watering conditions.

Three treatments were performed for each experimental group to determine quantitative and qualitative characters and experiment were performed during the same time period and with same biological material and in the same house.

This was the working schedule developed for Free-range broilers:

- treatment I (M): constant energy level and constant protein level;
- treatment II (F<sub>1</sub>): variable protein level and constant energy level;
- treatment III (F<sub>2</sub>): constant protein level and variable energy level.

5 groups with 10 birds each were used in each treatment in all the three experiments (table 1).

Groups were formed by day old chicks from same hatchery and from parents of same age to minimize genetic influence on results. Experimental period was 56 days using two phases feeding technology. Milled feed used in experiments was produced in I.B.N.A. – Balotești according to nutrient requirement of chicks used and based on the experimental schedule.

Performance parameters which were established and monitored weekly during the experiment for each treatment and group were as following: birds live weight, feed intake and livability.

*Table 1*

**Working schedule for Free-range broiler**

No.	Specification	M.U.	Phase					
			Production			Finishing		
			T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
1	Time	days	28	28	28	28	28	28
2	Flock	birds	50	50	50	50	50	50
3	Groups	no.	5	5	5	5	5	5
4	ME	MJ/kg	100	100	93.46	100	100	93.37
5	Protein	%	100	95.36	100	100	95.12	100

25% of flock was slaughtered at 56 days of age to determine slaughtering performances and chicks were weight before slaughtering and chicks representative for average group weight were chosen for slaughtering.

After slaughtering chicks were plucked, weight cut and carcass weight, breast weight, legs weight, wings weight, internal organs weight and remaining carcass weight were determined by using the cervical dislocation technique.

## 2. RESULTS AND DISCUSSIONS

Data about commercial efficiency and part of cuts from carcass and part of main internal organs both from live weight and from carcass were registered and processed to establish carcasses quality and to find production performances based on carcasses quality.

Final production performances of Free-range chicks are showed in table 2 and figure 1. Their analyze is showing that Free-range chicks are having an average live weight between 2096.14 g in group FM and 1964.08 g in group F2. F1 group had best specific consumption (2.51 kg), followed by F2 (2.58 kg.) and FM had worst specific

consumption (2.64 kg). All differences between groups are statistically significant. FM (92%) and F1 (91.60%) have best chick's liabilities compared to F2 (89.80%) but differences were not statistically significant. In conclusion best production results for Free-range chicks are those of groups with variable protein or energy with a significantly better feed efficiency.

Table 2

## Final production performances in Free-range chickens

Nr. crt.	Specification	M.U.	Flock					
			F M		F 1		F 2	
			X	S <sub>x</sub>	X	S <sub>x</sub>	X	S <sub>x</sub>
1	Weight vie	g	2096.14	43.91	2012.19	46.14	1964.08	50.59
2	Student Test	-	FM-F1=0.929		F1-F2=0.496		F2-FM=1.393	
3	Average Daily gain	g	36.83	0.78	35.31	0.83	34.47	0.91
4	Student Test	-	FM-F1=0.938		F1-F2=0.481		F2-FM=1.392	
5	Specific intake	kg	2.64	0.01	2.51	0.01	2.58	0.01
6	Student Test	-	FM-F1=19.326		F1-F2=11.150		F2-FM=10.292	
7	Cumulative mortality	%	8.00	0.65	8.40	1.69	10.20	1.15
8	Student Test	-	FM-F1=0.058		F1-F2=0.212		F2-FM=0.412	

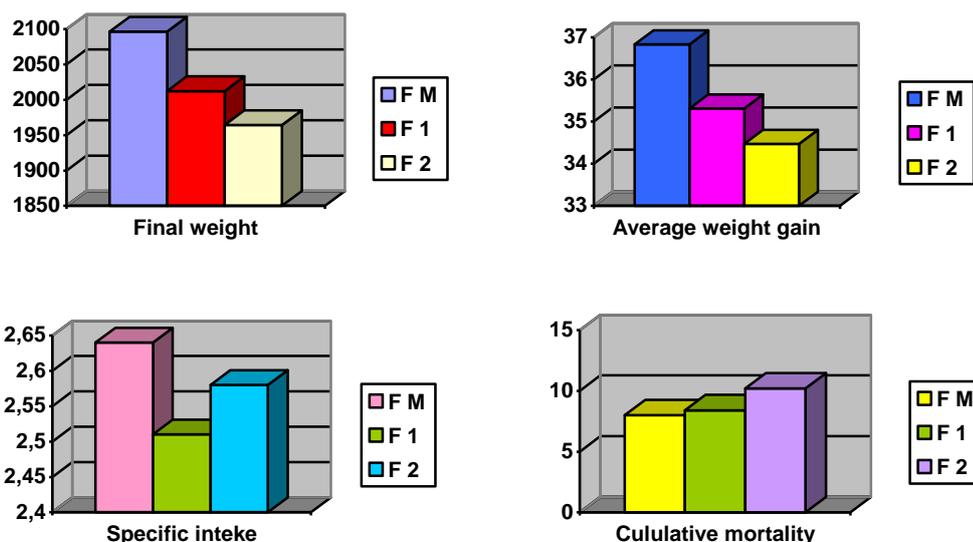


Figure 1 Final production performances in Free-range chickens

Table 3 is showing slaughtering performances influencing commercial meat value – represented by quality and quantity of commercialized meat. Analyze of data is showing different slaughtering performances based on analyzed treatment and studied index. Commercial efficiency is between  $75.45 \pm 0.35\%$  in group F2 and  $76.59 \pm 0.98\%$  in group FM, Breast percentage is between  $19.76 \pm 0.62\%$ , in group F2 and  $20.82 \pm 0.96\%$  in group F1; Legs percentage is between  $26.48 \pm 0.47\%$  in group F1 and  $27.42 \pm$

1.06% in group F2 and wings percentage is between  $10.21 \pm 0.11\%$  in group F2 and  $11.52 \pm 0.06\%$  in group F1.

Table 3

## Slaughtering performances in Free-range chickens

No.	Specification		Flock					
			F M		F 1		F 2	
			X	S <sub>x</sub>	X	S <sub>x</sub>	X	S <sub>x</sub>
1	Output (%)		76.59	0.98	76.25	0.45	75.45	0.35
2	Breast percentage (%)	liveweight	15.62	0.51	15.87	0.64	14.91	0.40
		carcass	20.39	0.40	20.82	0.96	19.76	0.62
3	Legs percentage (%)	liveweight	20.29	0.84	20.20	0.48	20.69	0.89
		carcass	26.52	1.45	26.48	0.47	27.42	1.06
4	Wings percentage (%)	liveweight	8.02	0.19	8.79	0.01	7.71	0.04
		carcass	10.47	0.11	11.52	0.06	10.21	0.11
5	Head percentage (%)	liveweight	3.21	0.11	3.91	0.13	3.36	0.03
		carcass	4.19	0.19	5.13	0.20	4.46	0.02
6	Gizzard percentage (%)	liveweight	1.78	0.15	2.13	0.02	1.69	0.07
		carcass	2.32	0.16	2.80	0.05	2.24	0.11
7	Back percentage (%)	liveweight	21.39	1.23	19.39	0.36	20.55	0.34
		carcass	27.91	1.24	25.42	0.32	27.23	0.58
8	Hart percentage (%)	liveweight	0.21	0.01	0.30	0.05	0.25	0.02
		carcass	0.28	0.01	0.39	0.06	0.33	0.02
9	Liver percentage (%)	liveweight	2.14	0.07	2.14	0.09	2.53	0.01
		carcass	2.79	0.05	2.80	0.13	3.35	0.01
10	Tibial percentage (%)	liveweight	3.93	0.20	3.54	0.54	3.78	0.31
		carcass	5.13	0.33	4.34	0.68	5.01	0.38

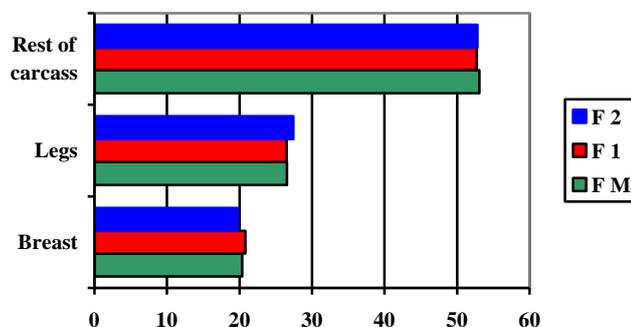


Figure 2. Percentage of different carcass components in Free-range chickens

## 3. CONCLUSIONS

- body weight was between  $1964.08 \pm 50.59$  g in group F2 and  $2096.14 \pm 43.91$  g in group FM;
- highest average daily gain was noticed in FM ( $36.83 \pm 0.78$  g) and lower average daily gain was noticed in F2 ( $34.47 \pm 0.91$ );

- specific intake varied between  $2.51 \pm 0.01$  in F1 and  $2.64 \pm 0.01$  in FM;
- cumulative mortality was between  $8.00 \pm 0.65\%$  in FM and  $10.20 \pm 1.15 \%$  in F2;
- commercial output was between  $75.45 \pm 0.35 \%$  in F2 and  $76.59 \pm 0.98$  in FM;
- highest breast percentage was noticed in group F1 ( $20.82 \pm 0.96 \%$  of whole carcass) and highest leg percentage was noticed in group F2 ( $27.42 \pm 1.06 \%$ ).

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## BIOMETRIC CHARACTERISTICS OF A GAME PHEASANT POPULATION FROM THE GHIMPAȚI PHEASANTRY, GIURGIU COUNTY

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U.S.A.M.V. BUCHAREST

**Key words:** biometric characteristics, game pheasant population, pheasantry, body weight, body and wing length, egg weight.

### SUMMARY

Since there are few published data on the exterior and egg characteristics of the biological material raised in the pheasantries in our country, the purpose of this study was to determine the main biometric characteristics of the population of pheasants in the Ghimpați pheasantry and perform a comparison of them with those previously determined in the same pheasantry and with pheasants data published by other authors. Measurements were made on a livestock of 80 females and 20 males, about 1 year old, birds taken at random from the flock. Individually live weight, wing length, and total body length were determined. 200 eggs were weighed.

The results showed that game pheasant raised in Ghimpați pheasantry is characterized in male adults aged 1 year by mean values of  $1686.5 \pm 9.71$  g body weight, of  $23.45 \pm 0.145$  cm wing length, of  $80.7 \pm 0.285$  cm body length and of  $33.42 \pm 0.250$  g egg weight. This figures are above the body weight of the adult game pheasant reported in the literature, under the determined wing length of the Common Pheasant, Chinese and Mongolian Ring-necked Pheasant as well as under the body length of the Chinese and Mongolian Ring-necked Pheasant. Egg weight exceeds the values reported in the literature.

Comparing the determined statistics index for body weight, wing length, body length and egg weight in 1977 by Scărlătescu G. M. and in 2010 at Ghimpați pheasantry, pointed out that in 2010 were achieved significantly better results.

The pheasants are part of the superorder Galloanserae, order Galliformes, family Phasianidae, worldwide existing 11 genera and 35 species of pheasants. In Romania the most important pheasants for game and culture belong to three subspecies of pheasant *Phasianus colchicus*: the Common Pheasant, *Phasianus colchicus colchicus*, Chinese Ring-necked Pheasant, *Phasianus colchicus torquatus* and Mongolian Ring-necked Pheasant, *Phasianus colchicus mongolicus*. Because of the repeated crossings between them and the formozan pheasant, *Phasianus colchicus formosanus* and the Green Pheasant, *Phasianus colchicus versicolor* resulted the game pheasant, which has the specific plumage coloration of the dominant species or subspecies and that populate the majority of game land and pheasantries.

The pheasant is spread over 20 million km<sup>2</sup> of surface globe, including large areas of Europe, Asia and North America. It is also found on the Pacific coast of South America, southern Australia and New Zealand. *Phasianus colchicus* in Europe is covering almost a quarter of its total area of distribution. Numbers of wild pheasants in Europe were estimated at 3.4 to 4.7 million pairs (after Bird Life Organisation, 2004). Although there was a decrease in the number in the years 1990-2000 in some regions of Europe, most of the stock was stable or even increased. The number of pheasants in Europe, representing 5-24% of the total number of the world, assessed to 45 - 300 million pieces. Data on numbers of wild pheasants show large flocks in Central European countries, but also in Northern Europe and the Balkan Peninsula, that Romania is part.

In the favorable geographical and socio-economic conditions, existing in Romania, pheasant is an important game species, like red deer, boar, rabbit or roe deer, which should occupy a more extensive area of the country, bringing a greater contribution to the game economy of our country, as happens in other countries.

Pheasant is of great importance both game - sport and fauna, economic and even for human consumption. His excellent flesh, with outstanding organoleptic properties is appreciated, as well as quail meat, for high nutritional value, containing 24% complex proteins, low-fat of 3.6% and an energetic value of 133 kcal / 100 g (Exequiel M.P., 1997). All this makes it a dietetic product to be used as healthy human food and in the treatment of metabolic and cardiovascular diseases.

Although pheasant was one of the first allochthonous species acclimatized in Romania (Unici R., 2001), its organized introduction in our country seems that dates from the late nineteenth century. At the height of its development, after World War II, in pheasantries were rise and valorized more than 400,000 pheasants. Today their number has decreased significantly, so in 2007 were raised 75,000 pheasants and in 2008 a number of 57,018, in just six pheasantries (Ghimpați, Pătulele, Cornești, Gherghița, Iersig and Pișchia, after the Ministry of Environment communic., 2010). In Romania there were only three pheasantries belonging to National Forest Administration in 2010. Status of the assessed game funds in Romania shows that in 2008 there were 344,948 pheasants and pheasant harvest was 57,316 (Ministry of Environment communic., 2010).

Intensive pheasant' rising is economically profitable, bringing considerable income to the producing units. By valorization of pheasants, on domestic or export market, especially in Italy, in 2008, were obtained revenues of almost 2,3 million lei. Revenues of a pheasantry consist primarily by turning pheasant chicks of different ages and body weights (day-old chicks, 10 - 14 days, 60 days, shooting pheasants, cocks of minimum 1.1 kg with the tail of at least 22 cm and the hens with the minimum weight of 0.8 kg, breeding pheasants for restocking, breeding reformed pheasants). Recovery of the live game at export is the most profitable form of valorization. Valorization of a pheasantry production can be realized by selling the eggs too, as hatching eggs or even as table eggs with high nutritional value. Pheasants can be sold on the domestic market or for export as slaughtered pheasants, unplucked, frozen or just chilled, as well as plucked and eviscerated pheasants („grill“).

Important source of income for the game ground consists of the fee paid per every shot pheasant piece; the killed game can be bought. Additional income is obtained from the sale of naturalized pheasants, which can serve as decorative or study objects by submitting them in game-themed museums and exhibitions.

In terms of fauna, pheasants, especially males, are very beautiful and attractive birds with vivid plumage color (metallic green, blue, rusty-red). Pheasant feathers are game trophy. Whole and naturalized pheasants can also be counted as game trophy. Decor pheasants (golden pheasant, royal, silver, Amherst, peacock pheasant), are very beautiful and colorful feathers, more than game pheasants. They grow and multiply quite difficult, but they are an ornament for enthusiasts' properties.

Since a long time have not been published data on the exterior characteristics and egg size of the biological material rise in the pheasantries in our country. So, the purpose

of this study is to determine the main biometric characteristics of a population of pheasants in the pheasantry Gherghița and to compare them with those determined by Scărlătescu G. M. (1977) in the same pheasantry and with data on pheasants published by other authors.

### 1. MATERIAL AND METHOD

The study was conducted at pheasantry Ghimpați, Giurgiu, with a total area of 11.7 ha and a production capacity of 10,500 pheasants a year. The pheasantry has: storage aviaries, 2 halls for rising pheasants chicks, 150 breeding boxes, 50 boxes for external rising pheasant chicks, incubation room with a capacity of 16,000 eggs per series, two grain warehouses.

At the pheasantry Gherghița measurements were performed on a pheasant breeding flock of 80 females and 20 males, aged about 1 year, birds taken at random from the flock. Individually were determined following parameters: body living weight, wing length, total body length, elements characteristic of the species and population. Were weighed 200 eggs of the 2010 laying. For each measured character, statistical indicators were calculated. The obtained values were compared by the Student test.

Wing length was determined by measuring the distance between the elbow and the tip of the longest feather. Total body length was measured from the tip of the beak to tail tip (Linția, D., 1954, quoted by Cotta V. and others, 2001). The measurements were accurate to 1 mm for measurements of body size, to 10 g for body weight and 0.1 g for egg weight.

### 2. RESULTS AND DISCUSSIONS

The results following biometric measurements made are shown in Table 1.

#### PHEASANTS BODY WEIGHT

The body weight of pheasants is one of the most important characteristics of species. Analyzing data from Table 1, we see that the body weight of adult females had an amplitude of 470 g, ranging between 840 and 1310 g. Average was of  $1030 \pm 8.86$  g. Their weight was uniform; the variability coefficient was below 10%. Males had in 2010 weights from 1590 to 1780 g. The amplitude was lower than in females, of 190 g. They have reached an average weight of  $1686.5 \pm 9.71$  g, by 39.94% higher than in females. Their weight was more uniform than that of females, the coefficient of variation being of only 2.57%.

#### WING LENGTH

Wing length is the second element of the species and gives indications on the quality of flight. At the game pheasants released, their flight affects the beauty and excitement of the game.

Wing length of females ranged between 17.1 and 22.8 cm, averaging  $19.71 \pm 0.180$  cm. The coefficient of variation was 8.21%. Male pheasants that year had wing length between 22.2 and 24.8 cm, averaging  $23.45 \pm 0.145$  cm. The coefficient of variation was only of 2.57%.

Table 1

Biometric measurements in 2010 compared to the values determined by Scărlătescu G. M. in Ghimpați pheasantry in 1977

Nr. Crt.	Measured biological parameter	Year of measurement	n	Limits / Amplitude	Average X	Error of average $S_x$	Coefficient variation Cv %
1	Female weight (g)	2010	80	840 – 1310 / 470	1013	8,86	7,79
2		1977	80	810 - 1140 / 330	989	8,04	9,10
3	Male weight (g)	2010	20	1590 - 1780 / 190	1686,5	9,71	2,57
4		1977	20	1000 - 1530 / 530	1270	3,13	11,2
5	Female wing length (cm)	2010	80	17,1 - 22,8 / 5,7	19,71	0,18	8,21
6		1977	80	17,0 - 21,0 / 4,0	18,86	0,098	4,67
7	Male wing length (cm)	2010	20	22,2 - 24,8 / 2,6	23,45	0,145	2,73
8		1977	20	20,2 - 23,5 / 3,5	21,35	0,20	4,26
9	Total female body length (cm)	2010	80	53,4 - 64,5 / 11,1	60,59	0,39	5,87
10		1977	80	48,0 - 62,5 / 13,5	55,68	0,413	6,06
11	Total male body length (cm)	2010	20	77,8 - 84,5 / 6,7	80,7	0,285	1,59
12		1977	20	49,0 - 83,0 / 34,0	66,0	2,877	19,45
13	Egg weight (g)	2010	200	27,9 - 39,4 / 11,5	33,42	0,250	37,61
14		1977	200	25,4 - 37,5 / 12,6	30,85	0,185	8,49

#### PHEASANTS TOTAL BODY LENGTH

The total length of female pheasant in 2010 was characterized by average body length of  $60.59 \pm 0.39$  cm and a coefficient of variation of 5.87%. In the same year, the

male pheasant reached the average body length of  $80.7 \pm 0.285$  cm, 24.92% higher than female. Amplitude difference between individuals of the sample was 2.6 cm, with 45.6% lower than in females.

#### PHEASANT EGG WEIGHT

Pheasant eggs weight rise in the Ghimpați pheasantry in 2010 was characterized by an average eggs weight of  $33.42 \pm 0.250$  g and a high coefficient of variation of 37.61%, egg weight being between 27.9 and 39,4 g.

Applying Student test and analyzing the data in Table 1, we see that in females there was a significant difference, of 41 g in body weights, of 0.85 cm between wing lengths and very significant, of 4.91 cm between the average body lengths determined in 2010 and 1977 by Scărlătescu G.M. In males differences were very significant higher, of 416.5 g in body weights, 2.10 cm in wing lengths and 14.7 cm in the total body lengths, determined in 2010 compared to 1977. Very significant differences between the two years were determined in terms of the weight of the eggs in 2010, which is higher than in the year 1977 with 2.57 g.

Compared with the weight of the whole common pheasant, which is 1-1.5 kg (V. Cotta, 2001), the pheasant rose to Gherghița was higher in both studied years. The results obtained during the study with the literature (Behnke-Lindemann, 1955) show that wing length is obviously lower in the common pheasant of Gherghița (25 cm), than in Chinese (28 cm) and Mongolian Ring-necked Pheasant (29 cm) and is very close to that of Japanese green pheasant (23 cm). The average length of game pheasant in 2010 due to Gherghița, compared with data from literature (Behnke-Lindemann, 1955), is very close to the Common pheasant (80 cm), lower than the Chinese and Mongolian Ring-necked Pheasant (90 cm and 94 cm) and higher than the Japanese Pheasant (75 cm). Weight of eggs from game pheasant of Ghimpați is higher than the 29 to 30 g given in the literature (Cotta V., 2001 Micu I., 2005), especially in 2010 (33.42 g).

### 3. CONCLUSIONS

The game pheasant raised in Ghimpați pheasantry is characterized in adults male aged of 1 year old by mean values of body weight of  $1686.5 \pm 9.71$  g, wing length of  $23.45 \pm 0.145$  cm, body length of  $80.7 \pm 0.285$  cm and egg weight of  $33.42 \pm 0.250$  g. This figures are above the body weight of adult game pheasant reported in the literature, under the wing length of Common pheasant, as well as under body length of the Chinese and Mongolian Ring-necked Pheasant. Egg weight exceeds values reported in the literature.

Comparing the statistical indices determined for body weight, wing length, body length and egg weight in the two periods: 1977 by Scărlătescu G. M. and from 2010, at Ghimpați pheasantry, the best results were obtained in 2010.

Further research is necessary to continue and to undertake studies on the breeding populations of pheasants in the main pheasantries of Romania, aimed to choose the best nucleus of selection.

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## PERFORMANCE IN MEAT PRODUCTION OF YOUNG NEW ZEELAND RABBIT ACCORDING TO GROWTH SEASON

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**Key words:** body weight, carcass weight, slaughter yield, cutting, season

### SUMMARY

The present research aims to study the performance in meat production of New Zealand rabbits according to the growing season, bred in semi-intensive system. The studied livestock was made of four groups, each of them containing 60 rabbits, in equal sex ratio from birth until the age of 180 days. The groups were analyzed according to the season they were born and annually, body weight, carcass weight, slaughter yield and cutting pieces. At the end of the experiment it was established that the highest live weight observed in rabbits reared in the spring season, was of 2502.17 g. This was followed in descending order by autumn, with an average of 2138.05 g, by summer 2100.34 g and the lowest weight was found during the cold season and was of 2029.62 g. The annual level average was of 2192.55 g, with a average error of 105.627 g. The result is that the most suitable season for the industrial growth of rabbits is spring. Satisfactory results were achieved in autumn and in summer seasons. Worst season in this regard was the winter, during which time the rabbits grow slowly and reach the age of 180 days with a small bodyweight and a small size of the longissimus dorsi eye muscle, resulting a low-quality housing. Considering cutting heavier pieces were obtained in spring because now there were the biggest carcasses. Anterior legs had 248.27 g with 39.64 g over yearly average and posterior legs had 424.15 g with 52.86 g over average, muscle weight was 232.08 g with 38.79 g over average, organs had 142.12 g with 23.02 g over average. Posterior legs proportion was not significantly different by season but proportion of the other cutting regions was significantly higher in spring then in winter.

### 1. MATERIAL AND METHOD

The experiment regarding the meat production performance of young White New Zealand breed according to growing season was held in biobaza Cantacuzino Institute. The biological material was represented by a population of laboratory rabbits in White New Zealand breed. The research was conducted on 240 rabbits, 60 heads analyzed for each season: summer, autumn, winter and spring. Youth rabbits was installed in semi-intensive system, in closed house with natural light and ventilation, no heating in winter. Accommodation rabbit cages was made of wire mesh in batteries tiered on two levels. Reproduction type was semi-intensive, and feeding was combined with granulated fodder throughout the year analyzed. Young rabbits was slaughtered at the age of 180 days. The following measurements were made: live weight, eye muscle area, carcass weight, coat weight, slaughter yield and proportion of parts cut from the carcass. The data were statistically processed for each season separately.

### 2. RESULTS AND DISCUSSIONS

At the age of 180 days, highest live weight was recorded in rabbits reared in the spring season of 2502.17 g. This was followed in descending order by the autumn, with

an average of 2138.05 g, the summer 2100.34 g and the lowest weight was found during the cold season of 2029.62 g. Average annual level was 2192.55 g, with an average error of 105 627 g.

Depending on the season in which rabbits were raised, the worst carcasses were obtained in the spring, with an average of 1736.32 g. In descending order, followed by autumn seasons, with average housing of 1520.77 g and summer, with 1504.30 g. The lowest value was achieved in cold weather, only 1467.14 g (Table 1, Figure 1). These values were proportional to weight that have made life a young rabbit in each season separately.

The average weight of fur varied according to season up to 15.20% from 368.47 to 312.53 g winter during summer. Average annual level was of 352.27 g. As expected the worst was the fur of winter, when fur is more dense to ensure animal body thermoregulation. In contrast with this the easiest fur, the rabbit was brought up in summer. For summer is a change in the density required for the animal fur can handle the stress of summer heat.

*Table 1*

**Slaughter results of young rabbits with age of 180 days according to the season**

Season	Live weight (g)	Carcass weight (g)	Fur weight (g)	Hot slaughter yield (%)
Summer	2100,34	1504,30	312,53	71,62
Autumn	2138,05	1520,77	363,21	71,13
Winter	2029,02	1467,14	368,47	72,31
Spring	2502,17	1736,32	364,86	69,39
<b>Total annual</b>	<b>2192,55</b>	<b>1557,14</b>	<b>352,27</b>	<b>71,02</b>

After slaughter and evisceration, the hot slaughter performance was calculated. It was at 71.02% annually. The highest yield was achieved in winter, of 72.31%. Then came the summer, with a rate of 71.62% and autumn, with 71.13%. The poorest performance was achieved during the hot spring of 69.39%, although this season was the highest weight. However the difference between seasons was not significant.

Carcasses were obtained from slaughter cut the most common pieces of butcher. Were obtained as follows: previous legs, back legs, muscles, organs, back of the carcass and the rest of the carcass (Figure 1).

Previous legs were at an annual average weight of 208.63 g. As expected the largest were those of the spring season that came from the biggest housing. Then came the autumn season, with a value close to the average of 218.04 g. The lower legs were obtained earlier in the summer of 194.09 g and 174.11 g cold weather.

Table 2

**Cutting carcasses of young rabbit according to growing season**

Season	Cutting piece	Weight (g)	% carcass	Cut piece	Weight (g)	% carcass
Summer	<b>Previous legs</b>	194,09	12,90	<b>Organs</b>	104,65	6,96
Autumn		218,04	14,34		119,29	7,84
Winter		174,11	11,87		110,33	7,52
Spring		248,27	14,30		142,12	8,19
Summer	<b>Hind legs</b>	356,81	23,72	<b>Back</b>	138,00	9,17
Autumn		360,14	23,68		147,19	9,68
Winter		344,07	23,45		145,26	9,90
Spring		424,15	24,43		154,71	8,91
Summer	<b>Muscle (longissimus dorsi)</b>	182,15	12,11	<b>Carcass rest</b>	529,10	35,14
Autumn		198,23	13,03		477,88	31,43
Winter		160,71	10,95		532,66	36,31
Spring		232,08	13,37		534,99	30,80

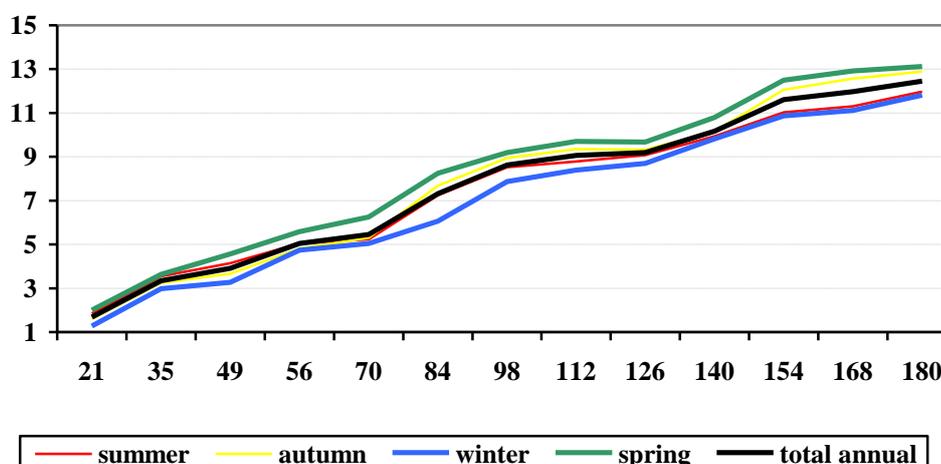
Table 3

**Cutting carcasses of young rabbit**

Cutting piece	Weight (g)	% carcass
Previous legs	208,63	13,40
Hind legs	371,29	23,84
Muscle (longissimus dorsi)	193,29	12,41
Organs	119,10	7,65
Back	146,44	9,40
Carcass rest	518,696	33,30

Hind legs were at an annual average weight, of 371.29 g and 23.84% of the carcass. The heavy legs were obtained on average in the spring season. Season average was of 424.15 g. This was followed in descending order, by the season of autumn, with an average weight of 360.14 g hind legs and summer, with 356.31 g. The low season, with a average weight of 344.07 g, 27.22 g less than the annual average, was the cold season.

Dorsal muscles, represented by longissimus dorsi muscle at the annual level was at the age of 180 days, an average weight of 193.29 g and represented 12.41% of carcass weight. The highest average weight was at the muscle derived from rabbits bred in the spring season, the 232.08 g and the lowest was in winter, to 160.71 g. The other seasons have had intermediate values.



**Figure 1 – Evolution of the eye muscle in young rabbits compared with live weight according to age and season.**

Bodies organs were represented by: liver, kidneys and heart. They were weighed together and had an average annual level of 119.10 g. Depending on the weight and the living and the default case, the hardest organs were obtained from rabbits bred in the spring. Their average weight was 142.12 g and represented 8.19% of the housing.

The autumn season weight is very close to the bodies of the annual average, below average values of 119.29 g were obtained in winter and summer seasons, the 110.33 g, respectively, 104.65 g.

The back was on average of 146.44 g, heavier than the average annual in spring season occurred when the average behind weighed 154.71 g, and autumn, when the average was of 147.19 g. Lowest level achieved was the season during the summer of 138.00 g.

The remaining case was at 518.66 g annually and represented 33.30% of its weight. Depending on the reporting season, the highest average was found in the spring, when the remaining case was an average of 534.99 g. This was followed by 532.66 g in winter then the summer with 529.80 g and in final of 477.88 g in autumn.

The proportion of rear legs did not differ significantly according to season, but the proportion of plants in other regions was significantly higher in winter than spring.

### 3. CONCLUSIONS

Regarding the experiment conducted on meat production performance of young White New Zealand breed according to growing season, were the following conclusions:

1. After slaughtering rabbits at 7 months of age it was found that the best season to obtain a good quality muscle with a good enough development is spring. Satisfactory results were also obtained during autumn and summer. The weakest season from this point of view was winter when rabbits are growing slow and so they have a small live

weight and a smaller surface of longissimus dorsi muscle at 210 days of age finally leading to production of low quality carcasses.

2. In conclusion rabbits with a live weight smaller than the yearly average of 2511.44 g, meaning those raised during spring, had also bigger carcasses of 1736.32 g and a similar efficiency in warm weather of 6.14% compared to all the other seasons. Season with values closest to average for live weight, carcass weight and slaughtering output was autumn.

3. Considering cutting heavier pieces were obtained in spring because now there were the biggest carcasses. Anterior legs had 248.27 g or 39.64 g over yearly average and posterior legs had 424.15 g or 52.86 g over average, muscle weight was 232.08 g or 38.79 g over average, organs had 142.12 g or 23.02 g over average. Posterior legs proportion was not significantly different by season but proportion of the other cutting regions was significantly higher in spring than in winter.

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## PHENOTYPIC CORRELATIONS BETWEEN EGG WEIGHT AND ONE DAY OLD CHICK WEIGHT DEPENDING ON THE AGE OF ROSS 308 HENS

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**Key words:** hens age, egg weight, weight chicken, phenotypic correlation, hatching

### SUMMARY

Taking into account that the incubation performance are constantly evolving, this paper aims to show how the main parameters of incubation at a high current hybrid meat are evolving and the phenotypic correlation between egg weight and chick weight at one day of age. For this a number of 4 batches of 100,000 hatching eggs per batch were followed on the entire hatching process and were calculated: egg weight, fertility, hatching percentage and hatched of fertile percentage, unhatched number of eggs and one day old chick weight. Age periods of the birds studied were: 25-35 weeks, 36-45 weeks, 46-55 weeks and 56-65 weeks. The results showed that egg weight was of 64.99 g. The average fertility rates, hatching and hatched of fertile had good values at the beginning of exploitation of the birds at 25-35 weeks, being of 93.72% fertility, hatching of 84.72% and 91.71% hatched of fertile. The best values of these parameters were recorded when birds were aged 36-45 weeks: Fertility - 94.84%, Hatching - 88.25% and Hatched of fertile - 94.06%. After this period, incubation parameters slowly decreased until the end of the operation. In the last studied period, aged between 56 - 65 weeks fertility was of 68.97%, 57.99% hatching and the hatched of fertile stood at 86.81%. Regarding unhatched eggs percentage, this parameter was lowest when parents age was of 36-45 weeks, 3.51% and higher when eggs were collected from parents by age of 56 - 65 weeks. Live weight of one day old chicks was lowest when the eggs set were from age of 25-35 weeks, 40.59 g, and highest when parents age ranged between 56 - 65 weeks. The correlation coefficient between egg weight and chick weight at the age of one day depending on age hybrid hens averaged 0.85, which shows that the two dimensions are strongly positively correlated. Values of incubation parameters for the meat hybrid achieved in the studied company were generally higher than those indicated by standard technology in most of the operating period.

### 1. MATERIAL AND METHOD

The experiment took place in the hatchery of the poultry production unit "SC Avicola Tărtășești SA", Dâmbovița county, specialized in growth of heavy breeds. The biological material was represented by eggs from a group of specialized hybrid parents for meat, raised on permanent litter and fed with mixed fodder. Eggs were marked, weighed and incubated, parents age were divided into the following sub periods: 25-35 weeks, 36-45 weeks, 46-55 weeks and 56-65 weeks. During the entire period of operation, followed incubation parameters were analyzed: fertility, hatching percentage, the hatched of fertile and the unhatched number of eggs. The data were statistically processed, the average, the average error and coefficient of variation were determined and were displayed in tables and graphs. At the end of the experiment, the one day old chicks were weighed and phenotypic correlation between egg weight and chick weight was determined.

### 2. RESULTS AND DISCUSSIONS

Weight of incubated eggs from hens hybrid developed from 59.14 g at the age of 25-35 weeks, to 69.18 g at the end of operation (Table 1). In the entire period of operation

the average weight of eggs was of 64.99 g with a mean error of 1.68 g and a coefficient of variation of 4.06%.

Table 1

**Hatching egg weight by age hybrid hens (g)**

Age of parents (weeks)	Results			Performance guide
	$\bar{X}$	$S_x$	c.v.	$\bar{X}$
25 – 35	59,14	1,56	6,11	56,71
36 - 45	62,98	0,71	2,97	63,43
46 – 55	68,69	2,14	4,36	66,99
56 – 65	69,18	2,29	5,84	69,77
Total period	64,99	1,68	4,06	64,23

Fertility of eggs was different from one age to another. At the beginning of the harvest, when hens were aged of 25-35 weeks, average fertility was of 93.72% higher than that provided by standard, which was of 92.50% (Table 2). This parameter increased with the age up to a maximum of 94.84% in weeks 36-45. After this period, the fertility rate declined progressively to lower values than the standard technology, accompanied by increased variability after the age of 56 weeks. Thus, fertility was of 86.82% during the 46-55 weeks, and the standard being of 91.35%. At the end of the operation, the fertility rate reached the value of 68.97% with an average error of 0.019 and a coefficient of variation of 8.16%.

The percentage of hatching in the early period of operation was of 84.72% with 2.08% less than standard (Table 2, Figure 1). During the operation, hatching rate increased, reaching 88.25% at the age of 36-45 weeks. After this period the percentage of hatching decreased gradually from 76.86% at age 46-55 weeks to 57.99% at the age of 56-65 weeks, values which are below the standard average. Throughout the analyzed period the hatching rate was of 76.96% with 7.23% less than the standard value of performance, of 84.19%.

Table 2 also shows that the hatched of fertile percentage throughout the experiment was higher than the technological standard. During the periods of ages studied, hatched of fertile percentage had different values. At small ages, between 25-35 weeks, the studied parameters had an average of 91.71%, with a rate of 3.22% variability. With increasing age the hatched of fertile increased up to 94.06%, around the age of 36-45 weeks. After this period, the studied parameters have decreased to a minimum of 90.37% at the age of 46-55 weeks. At the end of the reporting period, when the hens were aged 56-65 weeks, hatched of fertile has decrease to a value of 86.81% with 3.36% higher than the standard set for this hybrid.

Table 2

## The main parameters of hatching (%)

Age of parents (weeks)	Parameter	Results			Performance guide
		$\bar{X}$	$S_x$	c.v.	$\bar{X}$
25 – 35	Eggs fertility	93,72	0,011	3,33	92,50
36 – 45		94,84	0,002	0,67	89,30
46 – 55		86,82	0,014	5,01	91,35
56 – 65		68,97	0,019	8,16	83,15
Total period		86,09	0,013	6.28	89,08
25 – 35	Hatching Percentage	84,72	0,018	5,62	86,80
36 - 45		88,25	0,004	1,46	87,90
46 – 55		76,86	0,008	3,27	84,40
56 – 65		57,99	0,025	12,48	77,65
Total period		76,96	0,011	8.17	84,19
25 – 35	Hatched of fertile	91,71	0,010	3,22	82,80
36 - 45		94,06	0,005	2,13	86,80
46 – 55		90,37	0,002	2,20	86,70
56 – 65		86,81	0,014	4,95	83,45
Total period		90,74	0,007	3,27	84,94

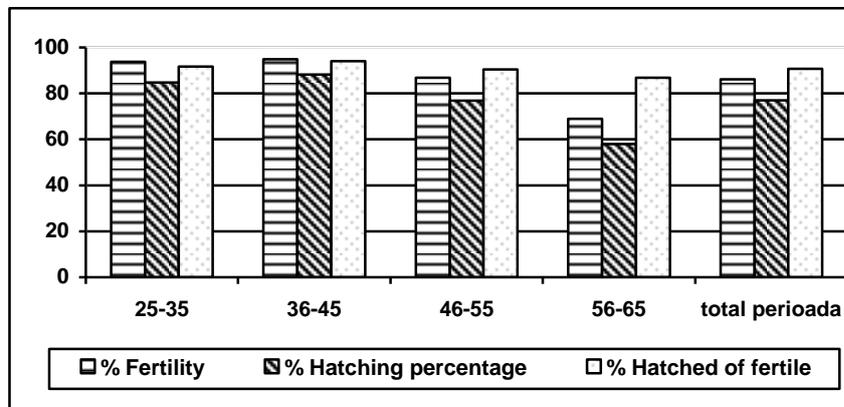


Figure 1 – Main parameters of incubation

The percentage of unhatched eggs was lowest when parents age was of 36-45 weeks, of 3.51% and then had showed an increasing trend. The highest value of 5.65%, was recorded when eggs were collected from parents aged 56-65 weeks (Table 3).

Table 3

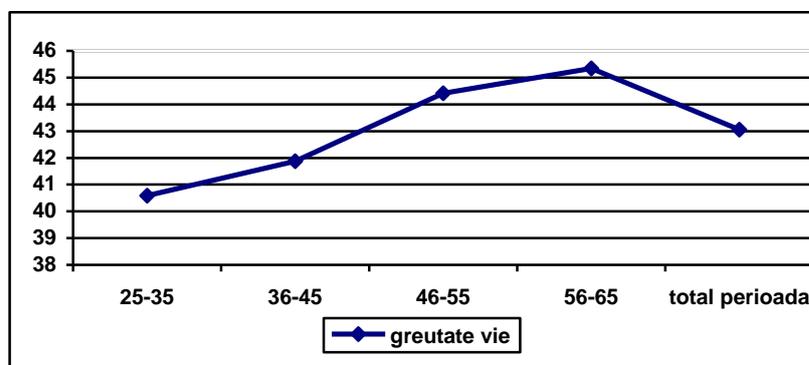
**Non-incubated eggs ercentage according to age of parents**

Parents age (weeks)	Unhatched eggs (%)		
	$\bar{X}$	$S_x$	<i>c.v.</i>
25 – 35	4,80	0,005	16,26
36 – 45	3,51	0,004	17,98
46 – 55	5,19	0,008	9,59
56 – 65	5,65	0,007	22,84
Total period	4,79	0,010	12,67

Table 4

**Weight of chicks according to age of hybrid hens (g)**

Parents age (weeks)	Results		
	$\bar{X}$	$S_x$	<i>c.v.</i>
25 – 35	40,59	0,96	8,03
36 - 45	41,87	0,59	3,86
46 – 55	44,42	1,26	3,29
56 – 65	45,34	0,76	4,57
Total period	43,06	0,97	5,88

**Figura 2 – Dynamics of the one day old chick weight depending on age of parents**

The lowest value of the one day old chick weight was in the beginning of operation (table 4), when the harvesting of eggs was from parents aged between 25-35 weeks, 40.59 g, with a coefficient of variation of 8.03%. And the highest chick weight, 45.34 g, was recorded when the age of the parents ranged 56-65 weeks. In the analyzed period the average was 43.06 g with a mean error of 0.97 g and a coefficient of variation of 5.88%.

**Phenotypic correlations between egg weight and one day chick weight depending on the age of the hens**

Parents age (weeks)	Egg weight (g)	Chicken weight (g)	The phenotypic correlation coefficient
25 – 35	59,14	40,59	0,81
36 - 45	62,98	41,87	0,86
46 – 55	68,69	44,42	0,88
56 – 65	69,18	45,34	0,88
Total period	64,99	43,06	0,85

Finally we calculated the correlation coefficient between egg weight and chick weight at the age of one day depending on age of hybrid hens (table 5). This parameter was an average of 0.85, which shows that the two dimensions are strongly positively correlated. At the start of the studied period the correlation coefficient was of 0.81 and has evolved to 0.88 at the age of 46-55 weeks and 56-65 weeks

### 3. CONCLUSIONS

Regarding the experiment conducted on main parameters of incubation at a high current meat hybrid are evolving and the phenotypic correlation between egg weight and chick weight at one day old, were made the following conclusions:

1. The weight of the hatching eggs from hybrid hens had evolved from 59.14 g at the age of 25-35 weeks to 69.18 g at the end of studied period. During the entire period of reserch the average weight of eggs was of 64.99 g with a mean error of 1.68 g and a coefficient of variation of 4.06%;
2. Fertility increased over the periods of ages studied up to a maximum of 94.84% in weeks 36-45 of life, then gradually decreased to values lower than standard technology reaching 86.82% between 46 - 55 weeks, the standard beeing 91.35%, and at the end of the operation stood at 68.97%;
3. The percentage of hatching in the early period of operation was of 84.72% with 2.08% less than the standard, but increased during the operation, reaching the age of 36-45 weeks at 88 25% and then decreased gradually to 76.86% at 46-55 weeks, and at the end of the operation at 56-65 weeks of age came to be 57.99%, these values being below the standard average;
4. The hatched of fertile, reflecting the quality of technology used in the hatchery during the period of exploitation of hens was higher than that provided by standard. At small ages, between 25-35 weeks, the studied parameter was in average of 91.71%. With age, hatched of fertile increased to 94.06% value, during the period of 36-45 weeks, after which it decreased to 90.37% at 46-55 weeks. At the end of the reporting period, at the hens aged of 56-65 weeks, hatched of fertile decrease to 86.81%;

5. The percentage of unhatched eggs was lowest when parents age was 36-45 weeks, 3.51%, having a tendency to increase with the age, the biggest values being recorded at parents aged 56-65 weeks;
6. The weight of one day old chicks tended to increase during the production cycle, starting from 40.59 g at the age of 25-35 weeks and reaching 45.34 g at the age of 56-65 weeks;
7. The correlation coefficient between egg weight and chicks weight at the age of one day depending on age of hybrid hens had averaged of 0.85, which shows that the two dimensions are strongly positively correlated. At the start of the period the correlation coefficient was of 0.81 and 0.88 has evolved to the age of 46-55 weeks and 56-65 weeks;
8. The current values of the incubation parameters studied in the the production unit were generally higher than the thenological standard, excepting the last part, when eggs were collected from parents aged between 56 - 65 weeks of age. Incubation indices represented by fertility and percentage of hatching, had lower values than the standard, although hatched of fertiles was higher. Further studies concerning the causes of the less satisfactory results of the eggs fertility after the age of 56 weeks, which seems to affect the percentage of hatching, are recomended.

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## **RESULTS OF STUDY ABOUT PROFILE OF CANDIDATES TO THE FACULTY OF ANIMAL PRODUCTION DURING 2008 - 2011**

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**Key words:** candidates, students, Career guidance, animal production engineers

### **SUMMARY**

The aim of this study was to analyze the profile of candidates who chose to apply for a place to the Faculty of Animal Production in Bucharest during 2008 – 2011. For this purpose questionnaires were filed by high school graduates applying for our faculty. Their answers were statistically processed and they were exposed in tables and graphics to be interpreted and used inside the Center for Career Guidance. The study showed that most candidates are coming from urban areas and mostly from Bucharest and some counties as Buzău, Prahova, Teleorman, Ilfov, Călărași, Ialomița, Dâmbovița, Argeș, Olt, Giurgiu, Vâlcea, Brăila, Brașov, Galați, Gorj, Vaslui, Bacău, Constanța, Tulcea, Covasna, Neamț, Vrancea and Hunedoara. 38.86% were informed about the faculty from de internet and 34.01% were informed from friends and 13.89% were informed from different media and 8.37% were informed by high school promotion and 4.69% were informed from other sources. Considering the level of knowledge most questioned high school graduates know to correctly use the computer and they know at least a foreign language and 89.24% are willing to upgrade their knowledge by learning a new language. Although most high school graduates have little knowledge about the way classes and practical courses are performed in our faculty an important percentage of 61.78% of them are willing to obtain a Master degree and 31.20% are even willing to obtain a Doctor degree and only 7.02% are not willing to perform post-university studies. 18.58% of candidates are having a job and 4.44% of them are working in the field in which they want to learn at the faculty although they are willing to perform post-university studies for a Master degree when they are applying for our faculty. 78.83% of students expressed their interest to participate in research contracts. This value increased from 26.38% in 2008 to 97.32% in 2011 during the years. And this is showing that research in animal production and in agriculture in general is turning more and more attractive for young high school graduates during the years. In conclusion the future student at the Faculty of Animal Production in Bucharest is generally coming from an urban area and he and she is knowing at least a foreign language and he or she had appropriate computer knowledge and he or she is willing to work in the field he or she are preparing for both during courses and after graduation.

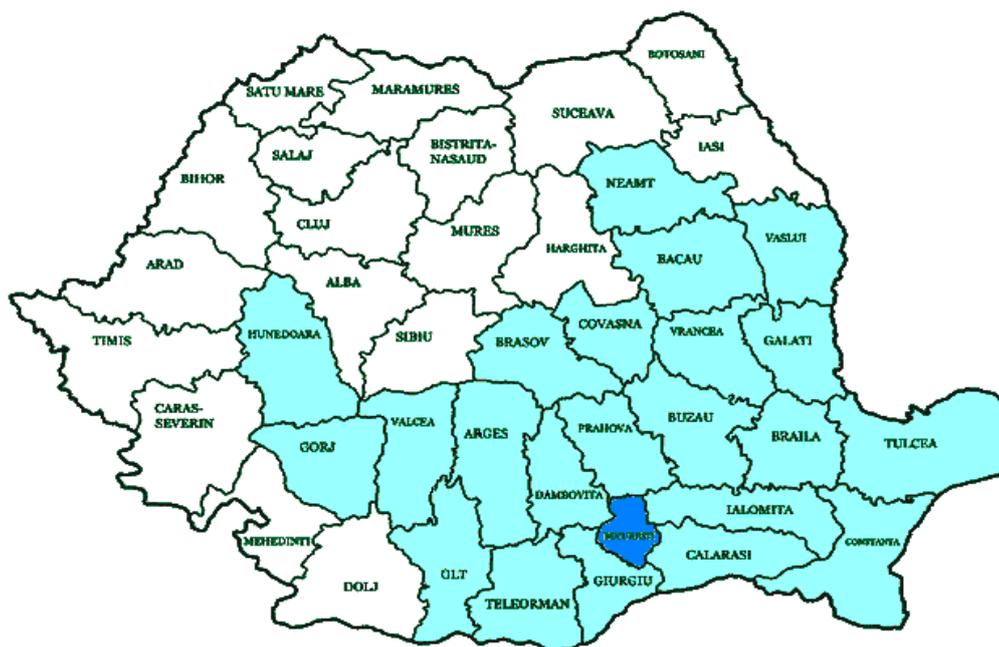
### **1. MATERIAL AND METHOD**

Changes in Romania Education both at university and pre-university level are asking for a study about the profile of the high school graduate applying for the position of university student. Study was performed at the Center for Career Guidance inside The Faculty of Animal Production in Bucharest during a period of 4 years during 2008 – 2011. This center is aiming to support present students in inside our faculty and to offer competent experts in animal production for the animal production industry and it has the following objectives: improvement of animal production university education quality, differentiate training of students, perfecting and upgrading the importance of practical studies, obtaining o coherent orientation of students to their chosen profession and organization of a jobs market in fields chosen by our students. In purpose of performing these objectives we worked out a questionnaire with 12 questions which was filed by candidates at the Animal Production Faculty when they applied for the summer sessions during 2008 – 2011. Questions were short and concise and they had alternative clear and

cut constructed answers and the respondent was assisted in filing the questionnaire to obtain best answers.

## 2. RESULTS AND DISCUSSIONS

Candidates to our faculty are generally coming from urban areas. In 2008 72.39% of them were from urban areas and 27.61% of them were from rural areas. This proportion has gradually evolved in favor of rural areas. And so in 2011 proportion was 32.89% and 62.42% for those coming from rural and respectively urban areas.



**Figure 1 – Counties of origin of candidates to Faculty of Animal Production in Bucharest**

Zones from which students are coming to our faculty are first of all Bucharest followed by counties Buzău, Prahova, Teleorman, Ilfov, Călărași, Ialomița, Dâmbovița, Argeș, Olt, Giurgiu, Vâlcea, Brăila, Brașov, Galați, Gorj, Vaslui, Bacău, Constanța, Tulcea, Covasna, Neamț, Vrancea and Hunedoara (figure 1). It is obvious that most candidates are coming from cities although our faculty is generally training people for working in rural areas and candidates are aware that they are going to work in a village or on the outskirts of big cities. When they were questioned about a possible journey to the workplace 70.14% of them answered that they are willing to travel to the workplace. This percentage varied between 83.43% in 2008 and 69.80% in 2011.

High school graduates are generally choosing our faculty 66.22% because they want to work in the field and 11.64 because they have a hobby and 11.89% because they need a diploma and 6.23% because parents asked them and ant the last 4.02% because

they are involved in a business in the field. 38.86% were informed about the faculty from the internet and 34.01% were informed from friends and 13.89% were informed from different media and 8.37% were informed by high school promotion and 4.69% were informed from other sources.

Most high school graduates questioned know at least a foreign language (table 1) and 89.24% of them are willing to upgrade their knowledge by learning a new language. English and French are the main foreign languages known. A small proportion of them know Spanish, Italian and German respectively 8.83%, 2.64% and 2.91%. During studies there did also occasionally found candidates know a less used foreign language as for example Greek, Russian, Hungarian, Arab or Portuguese.

Table 1

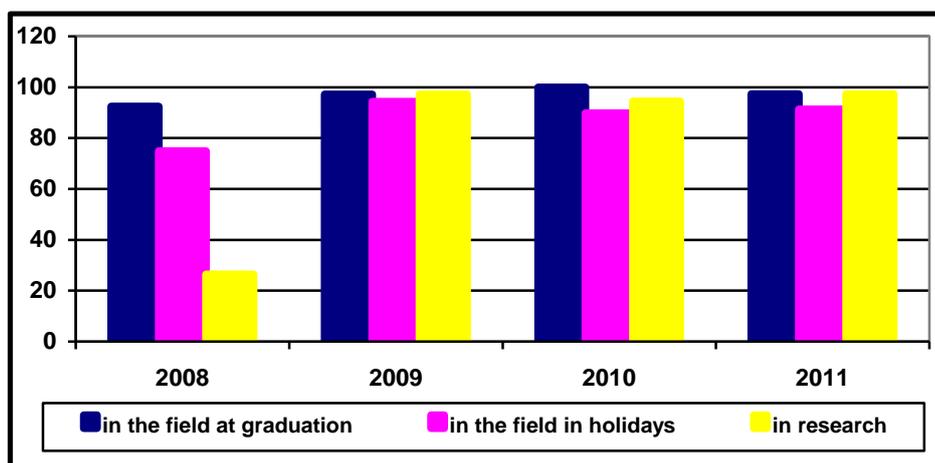
**Level of knowledge of at least a foreign language of candidates to Faculty of Animal Production (%)**

Specification	2008	2009	2010	2011	Total
English	55.34	45.87	48.59	52.19	50.50
Franc	33.59	34.67	37.02	29.93	33.80
Spanish	4.75	11.47	9.25	9.85	8.83
Italian	2.73	2.13	2.06	3.65	2.64
German	2.77	4.00	2.31	2.55	2.91
other languages (Greek, Russian, Hungarian, Portuguese)	0.82	1.86	0.77	1.83	1.32

95.51% of candidates know to correctly use the computer. This is a welcomed ability which is helping the future students to document themselves better about animal production and marketing and animal product processing. This percentage increased from 89.57% in 2008 to 99.33% in 2011 which is showing that nowadays generations are having an easier access to up-to-date learning techniques.

Although most high school graduates have little knowledge about the way classes and practical courses are performed in our faculty an important percentage of 61.78% of them are willing to obtain a Master degree and 31.20% are even willing to obtain a Doctor degree and only 7.02% are not willing to perform post-university studies. Apparently the young generations are perfectly aware of the importance of specialization by a Master degree in the profession they have learned during the faculty. It is interesting that number of students which are willing to perform Master degree at the end of the faculty is decreasing during the analyzed period and in 2011 only 59.06% of respondents are willing to perform post-university studies for a Master degree compared to 65.64% in 2008. Apparently the numbers of young people which are attracted by the title of „Doctor in sciences” are on the increase although most of them does not know the amount of work and knowledge necessary to obtain this title. During the study this percentage increased from 17.79% in 2008 to 36.24% in 2011.

18.58% of candidates are having a job and 4.44% of them are working in the field in which they want to learn at the faculty although they are willing to perform post-university studies for a Master degree when they are applying for our faculty.



**Figure 2 – Interest for working of candidates to Faculty of Animal Production**

When they were asked „would you be interested to work in the field during the summer holiday?” 87.59% of candidates gave an affirmative answer. Affirmative answers have increased from 74.85% in 2008 to 91.28% in 2011. Moreover an overwhelming majority of questioned people of 98.17% answered that they are interested to work in the field in which they will specialize themselves. Moreover they are willing to work even during the faculty courses period with prestigious companies in the field in which they have been studying to obtain a minimum experience so much needed to obtain an advantageous job at graduation.

A high percentage of our faculty's students are willing to work with research contracts to gain more experience in the field they have chosen during the faculty. Percentage of hesitating people is higher inside future students of our faculty because research does not look very interesting at first sight but our students are curious about the way a scientifically research is performed and its results are applied in commercial units.

78.83% of students expressed their interest to participate in research contracts. This value increased from 26.38% in 2008 to 97.32% in 2011 during the years. And this is showing that research in animal production and in agriculture in general is turning more and more attractive for young high school graduates during the years.

### 3. CONCLUSIONS

Following the experiment which was performed about the profile of candidates for the Faculty of Animal Production during the period 2008 - 2011 the following conclusions have been drawn:

1. The future student at the Faculty of Animal Production in Bucharest is generally coming from an urban area and he and she is knowing at least a foreign language and he or she had appropriate computer knowledge and he or she is willing to work in the field he or she are preparing for both during courses and after graduation;

2. High school graduates are generally choosing our faculty 66.22% because they want to work in the field and 11.64 because they have a hobby and 11.89% because they need a diploma and 6.23% because parents asked them and ant the last 4.02% because they are involved in a business in the field. 38.86% were informed about the faculty from de internet and 34.01% were informed from friends and 13.89% were informed from different media and 8.37% were informed by high school promotion and 4.69% were informed from other sources.

3. Interest for post-university studies for a mater degree or a Doctor degree and also for working in animal production or food industry research is on the increase. This is a good news because in this way there are good chances for a new generation of well trained specialists capable to easily integrate themselves and have good results in the working force market to be born;

4. 78.83% of respondents expressed their interest to participate in research contracts. This value increased from 26.38% in 2008 to 97.32% in 2011 during the years. And this is showing that research in animal production and in agriculture in general is turning more and more attractive for young high school graduates during the years;

5. 70.14% of respondents declared that they are willing to travel to the workplace. This percentage varied between 83.43% in 2008 and 69.80% in 2011.

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## **RADIO FREQUENCY IDENTIFICATION APPLIED TO THE PIG MEAT PRODUCTION CHAIN**

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**Key words:** pig, meat production, radio frequency identification

### **SUMMARY**

The pig identification is an important tool aimed to safely establish animal ownership, for animal health monitoring and control, food safety control, and finally for genetic selection. Therefore, a safe and reliable identification system is needed to ensure live animals and products traceability throughout the food production chain.

According to EU Council Directive 2008/71/EC of July 2008, concerning identification and registration of pigs, animals must be marked as soon as possible (and in any case before they leave the holding) with an ear-tag or a tattoo, which makes possible to identify the holding where the animals come from. Accompanying document must mention such ear-tag or tattoo.

Those basic EU legal requirements do not address more complex traceability systems required by the EU legislation (Regulation 178/2002 on food traceability) and, in addition, by the food industry, in particular for food produced under Quality Schemes. The paper describes, on the basis of the available scientific experiences, a new technique of identification of piglets with the aim to explore if and on what extent the proposed method could also be used as traceability tool for the production and processing of DOP food.

The pig identification is an important tool aimed to safely establish animal ownership, for animal health monitoring and control, food safety control, and finally for genetic selection. According to EU Council Directive 2008/71/EC of July 2008, concerning identification and registration of pigs, animals must be marked as soon as possible (and in any case before they leave the holding) with an ear-tag or a tattoo.

From daily practice, results that the ear-tags can be lost and illegally replaced, and tattoo can easily result in wrong readings and easily manipulated. In conclusion, classical visual identification, cannot offer the overconfidence, as the manual data input is prone to errors or fraud. Therefore, a safe and reliable identification system is needed to ensure live animals and products traceability throughout the food production chain and that could be the electronic identification. That is the only system, which can be easily integrated into any automated data collection, in fact the basis for a safe information system.

Several EID tags are marketed in Europe: EID transponders are incorporated in ceramic bolus, plastic eartags, or used as injectable transponders. In the latter case, the transponder is contained in a biocompatible glass-capsule, and the implant is administered by subcutaneous injection.

The use of injectable identification devices has been evaluated in many field studies, and methodologies for electronic identification (ID) of swine are currently

available in the scientific papers. Almost all tests focused on loss rates of transponders, and the recovery during slaughter (1,2,3).

#### Objective of the research

The purpose of study was to assess if subcutaneous injectable transponder methodology can be used as a mean to ensure full traceability in the production scheme, in other words, to design a system which can safely cover the whole process of production from the live pigs in the farm to the processing of the hams (farm → slaughterhouse → processing plant) with the use of the same EID.

At the farm level, the first step was to evaluate if the calcaneum area is a proper injection site in piglets.

In order to explore the feasibility of the proposed injection area, we have taken into consideration several elements, as general husbandry technology and regular animal behaviour.

### 1. MATERIAL AND METHOD

**Animal Test Group.** The study involved a sample size of 566 piglets, hybrid Large white Landrace. Were made preliminary investigations concerned the husbandry environment during the farrowing phase (cleaning and disinfection procedure, ventilation system) and animal condition (vaccination, health condition). The cycles of production system were not performed in a unique farm, but several farms were involved with frequent transfer sometimes covering very short cycle(s). The involved farms were located in an area of 100 square kilometres. The decision on which animals have to be transferred, where and when was of the farm staff, without our pre-informing and without keeping a safe record of the movements. This has made the monitoring of the performance of the project very difficult, if not impossible.

**Electronic Identifiers.** A cylindrical, glass encapsulated transponder, has been used to identified electronically the piglets. It is full duplex technology (FDX-B), with 3 mm in diameter 15 mm in length; weight 0, 25 g, insert in the needle of a sterilized syringe (Figure 1). A particular treatment with parylene reduced the migration of transponder after the injection (parylene is a coating plastic film).



Figure 1. Transparent polypropylene package with two syringes and FDX-B transponders

The syringes were produced in couple carrying the same 12 digits individual code. In order to identify the 2 hams of each piglet, the 2 transponders have been programmed with a different code in the transponder filed “reserved for future application” (01 for green syringe –right leg and 02 for blue syringe - left leg). The

transponders were packaged in a propylene transparent bag accompanied by a paper written code. The 12 digits codes were progressive.

Also a conventional ear tag has been used to further identify piglets involved in the study.

Description (Protocol) of the Method of Implantation. The identification procedure foresees to tag piglets on the external – lateral side of the calcaneum, parallel with vertical axis of calcaneum bone (Figure 2).

Depending on the length of the needle, the animal's skin should be penetrated at suitable point, (Figure 3. A) along the metatarsus V region. The needle is then moved subcutaneously, along the vertical axis of the metatarsus V, in the latero-plantar direction of the calcaneum. The tip of the needle should be positioned at the base of the calcaneum (Figure 3. B )

The restraining of the piglet and implanting of the transponder can be carried out by a single staff, when the piglet's age is between one day and maximum 3 days.

It is obvious that the injection of transponder carries a certain risk of infection. The whole region of implant should be therefore properly cleaned and disinfected before the injection.



Figure 2. Lateral side of calcaneum region with subcutaneous transponder

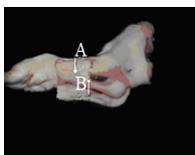


Figure 3. A.The point of needle penetration. B. The point where the transponder is leave

Static and Dynamic Reading. The readability of the transponders before and after the injection was verified using two different types of portable reader (Gesreader 2 and Psion Workabout Pro with Agrident reading head). The first static reading had been performed before tagging the piglet to prevent the use of a faulty identifier. In addition, a second reading was performed after the tagging as “control reading” to verify the transponder readability. With this first post-application reading was possible to issue the "previous list" (i.e. the list of tagged piglets expected to be read during the following control readings).

The comparison between reading sessions performed at predefined dates allowed to record the retention rate as well as the proper functioning of transponders. More than ten reading sessions were performed in the entire duration of the study.

The dynamic reading was performed to test if the position of transponder implant is appropriate for this reading method, and if it can be applied to improve the regular management of animals. This technique would allow the farmer to have a full control of

the animal population, of the registration of off/on movements of the pigs, including an automatic registration of the delivery date to the slaughterhouse. A dedicated raceway was designed and manufactured, with the aim to ensure the necessary flexibility in order to accommodate animal of different size and age (Figure 4 a,b,c). The antenna was installed in the last part of the raceway with an angle of 20 degree.

The antenna is connected with the RF Unit which reads the animals once they move close to the antenna and performs automated comparison of the expected, store data (previous list) with the readings performed.



Figure 4 (a,b,c). The dynamic reading ; design of the raceway

Structure of the transponder code. The structure of transponder code complies with the ISO standard. As mentioned earlier, in order to identify the 2 tagged legs the ISO 11784 field “reserved for future applications” (2 digits) was used. The transponders were programmed with value 01 if dedicated to identify the right hind leg, and with value 02 for the transponder dedicated to identify the left hind leg ( example : 1 0 03 01 0 941 000011010783 and 1 0 03 02 0 941 000011010783).

Observations on the Pig farm Management and Health control.

In farrow, systematic examination of batches of piglets from same sows demonstrated that cross fostering concerned about 70% of litters. This practice resulted in creating an obvious problem for a safe monitoring of the RFID tagged piglets belonging to the same litter. At the moment the project was implemented, the herd was affected by several cases of enteritis, insufficiently kept under control. In the observed production system, fattening and finishing pigs were housed indoors in stalls with large number of pigs per square meter. An excessive density of animals per single pen was observed, if compared to the feeding space. Even if ad libitum feed procedure is applied, 25-30 pigs per feed space is considered a too high density.

Observation after the tagging

Reaction of Animal Tissue, after Transponder Implant. Clinical signs. Insertion of the transponder with the injection needle resulted in a wound approximately 2 mm Ø with a slight local haemorrhage.



Figure 5. Slight local haemorrhage.

No swelling, itching or inflammation was noticed on the periodic examinations of the injection area. The wound completely disappeared in a week.

In the next weeks no inflammatory or any proliferative processes could be observed in the injection area.

Observation of the Tissue Reaction in the injection area.

After implantation of a biomaterial the tissue response at the injection site and in the surrounding tissues have an important impact on the possibilities of device migration. The biological response to an implant can be attributed to acute and then chronic inflammatory reaction, with the consequence of a fibrous capsule production (Figure 6 a,b). The results observed in the study, by using Parylene C glass covered transponder implanted in soft tissues, generally pointed out the same findings of other authors describing the use of several other type of bio-neutral glass covered transponders in animals.

Usually, the progressive development from acute to chronic inflammatory process implies the production of a capsule of fibrous connective tissue around the transponder. The fibrous capsule around the transponder showed a macroscopically good aspect.



Figure 6. a, b The reaction of the host connective fibrous fascia and periosteum provides a good encapsulation for the transponder.

## 2. RESULTS AND DISCUSSIONS

The study was conducted on 567 animals, over a 49 -wk period (from newborn to finishing), to assess the suitability of a new transponder's implant methodology and to explore the potential of radio frequency identification as a method to ensure a safe identification of animals applicable to the traceability of hams.

As mentioned earlier, one of the major problems we encountered during the implementation of the field test was the practical impossibility to keep the involved animals in the same groups, in order to avoid that tagged and not tagged animals could be mixed together. Frequently, we could not monitor (as planned) the retention rate in the same group of animals simply because at the moment of the control reading the animals were not where they were supposed to be, but they were moved according to internal management (other farms, other sections) without a safe recording.

In addition, it was extremely difficult to properly follow the study as originally designed, not only for the constant re-distribution of piglets inside the farms involved, but also for the lack of communication concerning the list of animals whose production cycle was completed and therefore considered ready for the slaughtering. Only in one exceptional circumstances we succeeded to be present at the slaughtering of some animals of the test group. During the slaughtering operations in the abattoir we observed a number of malfunctioning (non readable transponders) in several animals. Out of the 13 animals delivered to the abattoir in only 3 cases the 2 transponders were still readable, but

in the other 10 animals one of the 2 transponders was not functioning. In order to further explore the possible reason of the observed problem it was possible, on a very limited number of cases (5 in total), to recover the non-readable transponders which were, in fact, broken (see the following pictures – Figure 11).



Figure 11 and 12. Hams, with broken encapsulate transponder

### 3. CONCLUSIONS

In assessing the possible reason(s) of such high failure rate we should take into account a number of aspects:

the status of quality of electronic device;

the regular behaviour of the pigs, in particular in the second part of the fattening phase.

The value of read-failure rate starts to be detected, after 90 days after transponder's implant and becomes more evident during the last period of fattening, and varied with housing system. During that phase changes in social behaviour of pigs became evident as they got heavier, and an increased incidence of fighting/biting during frequently regrouping or access to feeding system was observed. Therefore, an additional element to be explored is also the possibility that the frequent fight in the later phase of fattening combined with the location of the transponder (external leg side) may have resulted in a transponder breakage. This is confirmed by a number of evidences collected in the slaughterhouse, where transponders removed from the carcasses were found broken (see also the following picture) and the breakage probably occurred before slaughtering as the fragments were included in a well formed fibrous capsule and small and focal haemorrhage were observed as indication of a recent trauma.

Therefore, a general conclusion can be drawn that the quality of electronic devices used does not fit with the observed farming practice. Also, alternative injection sites, which may address the observed disadvantages, have to be explored. An additional possibility could also be to benefit safer and more tested ID procedure(s) of live animals with the aim to integrate it into a more exhaustive information system covering the whole production chain.

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## EVALUATION OF THE PERFORMANCE OF STATIONARY MILKING SYSTEMS USED IN DAIRY FARMS IN TURKEY

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**Key words:** milking system, vacuum fluctuations, milk quality

### SUMMARY

In parallel with the increasing human needs, the increase of demanding for milk and milk products has gained an important dimension to dairy farms. Milking mechanization in dairy farm has not only the biggest share in terms of working time, but also is the major hard work. With the help of milking machines, clean and hygienic milking of milk and the increase of milk productivity can be provided. Milking machines affect the need for human labor, and cow's lactation yield, and the health of under and milk quality. At the same time, improper use of milking machines can lead to longer of milking span, reduced milk yield, deterioration of milk quality and udder health.

In this study, operating parameters such as vacuum pressure, pulse rate, pulse rate deviation, pump capacity, spare capacity of domestic and imported dairy milking facilities, which are widely used in our country, determined and compared.

Increasing demand for milk and dairy products in parallel with the increasing human needs dairy farms. Milking mechanization in dairy farm does not only have the biggest share in terms of working time, but it is also one of the hardest works in the dairy.

With the help of milking machines, clean and hygienic milking of milk and the increase of milk productivity can be achieved. Milking machines affect the need for human labor, and cow's lactation yield, and the health of under and milk quality. At the same time, improper use of milking machines can lead to longer of milking span, reduced milk yield, deterioration of milk quality and udder health (Nalbant 1987).

In our country, in dairy farms, milking process approximately make up 55 to 65 % of the works in the farms. Therefore, using an appropriate milking machine is a must for the acceleration of milking, reducing man power to minimum, protection of animal health and obtaining clean milk (Özdemir et al., 2000).

In a regular milking, to obtain adequate vacuum debit, the pump quality, pipe length and diameter is to be chosen very well. A milking machine can perform properly depending on continuous air flow with adequate debit and press. In critical places of milking machine, especially air debit losses in milking units lead to vacuum losses. Therefore, air debit is to be high enough to compensate normal losses.

While vacuum pump capacity is required to be adequate for milking system, the diameter of the pipeline through which vacuum is transmitted is to be appropriate. In choosing pipes, pipe characteristics like length, diameter and surface smoothness are to be considered.

Mechanized milking is achieved with "animal, human and machine" triple. These three components which make up a system are all in a continuous relation. The animal's

being used to mechanized milking, experience and skills of milkman and functional and operational characteristics of “milking machine” affect expected level of success in milking (Işık and Ünal, 2003).

Pulsator pulse numbers is to be between 50 and 60 pulse/d for proper pulse. Pulse number is influenced by vacuum level and medium changes  $\pm 5\%$  deviation is acceptable (Appleman 1993, Bilgen et al. 1992). If pulse number is very slow, blood flow in the udder slows down and it hurts animal. In case it is high, the flow of milk is enhanced by 10% milk can be left in the udder. Milk left in the udder is one of the most important reasons for mastitis (Ünal 2001).

In a pulse, total of vacuum increase (phase A) which is milk taking phase and the highest vacuum phase (phase B) is pulse-movement rate. In making pulsator, these rates are at 50%, 60% or 70%. The deviation value of the pulse rates measured at two sides of a milking unit is not to be more than  $\pm 5\%$ . If this deviation value is exceeded, this can lead to inadequate or excessive message to udder and thus inadequate or excessive milking under vacuum. Each milking unit and highest vacuum phase determined in their half (phase B) is not to be less than 30% and the lowest vacuum phase (D phase) is not to be less than 15%. Values lower than these mean inadequate milking debit and inadequate udder message. Message is more important for udder health (Anonymous a,b, Bilgen et al. 1992).

Studies on milking machines it is pointed out that the effectiveness of machine is related with pulse number in udders, pulse rate, vacuum and vacuum fluctuations, vacuum pump and milking unit capacity. Pulse number is to be between 40 and 75 pulse/min, pulse rate 50/50, 60/40 or 70/30, vacuum value is to be between 37-50 kPa, deviation in vacuum when working is to be  $\pm 2$  kPa and the debit of the vacuum pump is to be as mentioned in literature (ISO 5707, TS 4798, anonymous c, Sungur et al. 1990). In milking, 60/40 pulse rate, 55 pulse/min. pulse number and 50 kPa vacuum pressures are widely used values (Appleman 1993, Bray et al. 1993, anonymous b).

In Turkey, Milking Machine (MM) manufacture was started in 1978, today more than 30 firms manufacture milking machine. However, there are serious problems with domestic milking machines. These problems are especially related with materials choice in udder rubber, vacuum pump, regulator and pulsator, design, production, quality control, facility and enterprise processes (Bayhan et al., 2000). Domestic manufacturers generally focus on the production of mobile milking machine; however, recently they have started to manufacture milking facilities thanks to subsidies and incentives.

In this study, operational parameters of domestic and foreign milking facilities were determined and compared.

## 1. MATERIAL AND METHOD

In the tests, milking machines of 2 imported and 2 domestic brands were assessed in 40 milking facility. The characteristics of the facilities with four different firms are given in **Table 1**. In the tests, considering limit values in the standards the vacuum pressure of the machine was adjusted to 45 kPa, pulse number was adjusted to 60 pulse/min.. Pulsator pulse rate was between 60 and 40. In this study, for each facility

pump capacity, effective spare capacity, vacuum losses and pulse parameters were determined.

Table 1

**Technical and physical characteristics of milking facilities in the tests**

		Import-A	Import-B	Domestic-A	domestic-B
Power source		Tri-phase Electric Motor			
Movement Transfer System		Bet-Pulley			
Vacuum Pump Type		Palette – oily			
Vacuum Storage Volume (l)		75	30	100	75
Pulse Systems	Pulsator	Electronic			
	Pulse movement	Alternate			
	Pulsation	Adjustable	Adjustable	Adjustable	Constant
Milking Units	Weight (g)	2100	2450	2200	2400
	Volume (ml)	360	200	350	500
Reserve tank capacity (l)		80	80	60	60
Regulator		Servo			

In order to determine structural and functional performance of milking machine in enterprise conditions, Exendis brand (PT-V) electronic pulsator tool and debit-meter were used. The device was arranged to measure four functions:

- Pulse analyses,
- Measurement of highest vacuum point in pulse period,
- Recording minimum, maximum and average vacuum level in 60 sec.
- Analogues printing of continuous record and vacuum level.

In pulse analyses, according to international standards, each pulse circuit of the device was divided into four phase at  $\pm 4$  kPa in short milk pipe:

Phase A : Increasing vacuum phase,

Phase B : Maximum vacuum phase,

Phase C : Decreasing vacuum phase,

Phase D : Minimum vacuum phase.

These four phases mean opening of udder rubber (phase A), complete opening (phase B), closure (phase C) and complete closure (phase D). Accordingly, pulse rate is defined in the following equation:

$$\text{Pulse Rate} = (A + B) / (A + B + C + D)$$

During milking, thanks to a device connected to the milking machine, the total of A+B, C+D phases and results of A,B, C, D phases as percentage, pulse number, (pulse/min), working vacuum pressure (kPa), pulse rate deviation (%) values were shown on numerical screen and were also recorded in the computer. In order to test machine equipment adequacy, it is necessary to measure vacuum levels at different points in the system. In order to determine vacuum fluctuation in the system, main vacuum level was

measured at least at every 60 sec. period and minimum, mean and maximum pressures were recorded. Test results with the device were analyzed and evaluated according to data from literature.

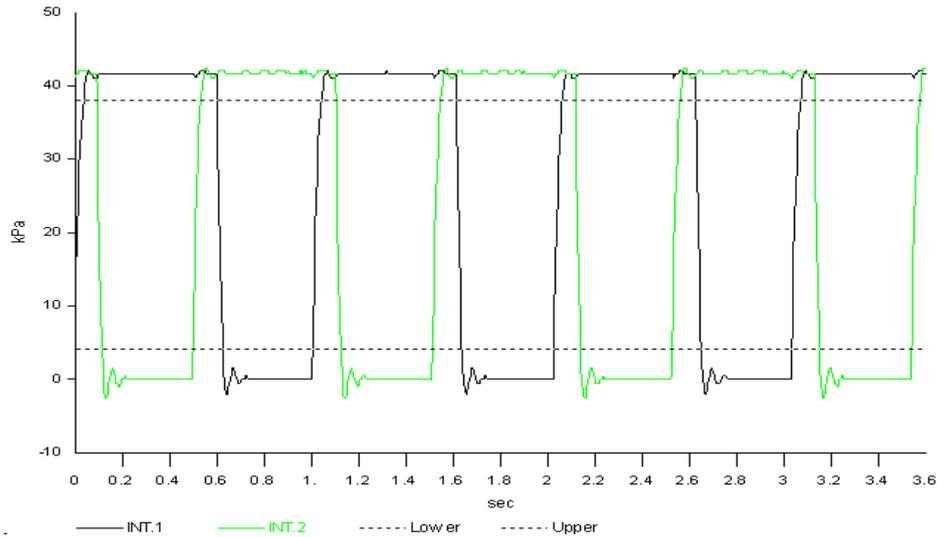


Figure 1. A sample vacuum phase changes and pulse value graphic

## 2. RESULTS AND DISCUSSIONS

Mechanic function test results of facilities of each firm with 10 milking units and the values recommended in ISO standards are given in **Table 2**.

When Table 2 is examined, it is seen that vacuum pump capacities and effective spare capacities are higher than values prescribed in standards. This case indicates that milking performance is adequate. In all facilities, regulators with similar working principles were used. It is seen that regulators show performance close to standard for all facilities.

Vacuum decrease values in vacuum system in all machines are lower than standard values. It was determined that atmosphere air entering in through the hole on the clutch is within desirable limits for all facilities. While the highness of this debit lead to decreases in vacuum, inadequate debit leads to problems in carrying milk to milk can especially in high milking debits. It will lead to severe vacuum fluctuations in the whole system and particularly in the udder if the hose is filled with milk.

In Table 2, the pulsators' phase values for each firm are given as percentages. When pulse numbers are examined, the pulse number values measured are within reasonable limits. In measurements, it was determined that mean pulse rate ranged between 59.9% and 60.1%. In other words, the difference between pulse rate values in udders under the effect of different phases was determined to be within 5% limit values prescribed in the standard. On the other hand, it was determined that deviation rate sucking phase totals (A+B) and massage phase total (C+D) measured in both canals

ranged between 0.2% and 0.5%. This result is acceptable result as it is between  $\pm 5\%$  standard limit values. It is desirable that phase A measured in both canals be less than 30% and that phase B be less than 30%. The 56.8% and 61.8% values measured are above percentage limits and confirmed to be suitable values. In case phase B is lower than 30%, it is mentioned in literature that it leads to irritation in udders and to mastitis. Phase C is the period when vacuum record is done in the pulse room when air is re-taken into pulse room and udder rubber because of atmosphere pressure outside and air pressure changing inside like milking vacuum. During this phase, pulse room is under atmospheric pressure and blood flows to udders as a result of message by udder rubbers. In literature, the limit values of phase C is determined. D phase is not to be more than 15% so that animal udder can be comfortable. Excessively fast pulse rate and high pulse number lead to very short phase D. As a result, phase C is extended. According to measurement results, D phases in the firms' machine which were measured to be f 34.3%, 37.5%, 38.3% and 38.1%, respectively are higher than limit values and at suitable values.

Table 2

**Results of mechanic process tests in facilities**

Parameters		Machine				ISO values
		Imported-A	Imported-B	Domestic-A	Domestic-B	
Vacuum Pump	Capacity (L min <sup>-1</sup> )	1300	1170	1031	1250	910
	Effective reserve cap. (L min <sup>-1</sup> )	974	954	767	540	350
Regulator	Sensitivity (kPa)	0.2	0.1	0.2	0.1	<1
	Loss (L min <sup>-1</sup> )	4	9	2	25	<35
Vacuum Decrease	Pump-regulator (kPa)	0.7	1.2	1.4	1.3	<3
	Regulator-milking units (kPa)	0.1	0.2	0.4	0.2	<2
Milking System	Air inlet (L min <sup>-1</sup> )	8	9	6	8	4-12
	Air leakage (L min <sup>-1</sup> )	22	9	4	14	<0.05xC. V
Pulse System	Pulsation (min <sup>-1</sup> )	59.9	60	60.1	59.9	60 $\pm$ 5%
	Pulse rate (%)	60/40	60/40	60/40	60/40	$\pm$ 5%
	Vacuum (kPa)	43.3	42.8	43	44.1	
	A	2.3	3.5	2.8	2.2	
	B	61.8	56.8	57.4	58.4	>30%
	C	1.6	2.2	1.5	1.5	
	D	34.3	37.5	38.3	38.1	>15%
	A+B	64.1	60.3	60.2	60.6	
	C+D	35.9	39.7	39.8	39.6	
Limping	0.3	0.2	0.2	0.5	<5%	

### 3. CONCLUSIONS

- When imported and domestic machines are compared as a result of tests in facilities, it can be said that domestic machines and imported machines work with equal performances.
- Domestic pulsators work as regularly as imported pulsators.
- In terms of milking units, unit characteristics are all adequate both in facilities of both domestic and imported firms.
- In terms of loss and leakages, it is seen that montage quality of imported and domestic firms is good.

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## CHANGES IN SOME CHEMICAL CHARACTERISTICS, STABILITY AND FATTY ACIDS COMPOSITION OF HUBBARD CHICKEN FAT DUE TO FREEZING AND ROASTING PROCESSES

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**Key words:** Poultry, chicken fat stability, freezing and roasting processes, storage stability.

### SUMMARY

The effect of freezing and roasting processes as well as frozen storage at  $-20^{\circ}\text{C}$  for six months on some chemical characteristics, stability and fatty acid composition of chicken fat were determined. The results revealed that the freezing and roasting processes caused a gradual increase in the values of F.F.A., P.V., T.B.A., S.V., T.S., monoenoic acids and ratio of  $C_{18:1}/C_{18:2}$  for all fat samples. Further increase was observed as the storage period increased. In contrast, a slight gradual decrease was recorded in the values of I.V.,  $C_{18:2}$ ,  $C_{18:3}$ ,  $C_{20:4}$ , T.U.S. and the ratio of TUS /TS. The rate of change (either increase or decrease) depending on the initial value, storage period and type of fat (skine or muscle). Also, it was noticed that the decrease in the values of  $C_{18:2}$ ,  $C_{18:3}$ ,  $C_{20:4}$  and T.U.S. was accompanied by decreasing in the I.V. value. In addition, the results indicated that the P.V. and T.B.A. values were higher in muscle fat samples than in skin fat. These mean that the muscle fat of chicken are less stable and highly oxidized than those of skin fat samples.

Now, more attention is being directed to increase the amount of poultry production to cover the shortage in animal proteins. Most of poultry used for food are: chicken, pigeons, duck, geese and turkey. The rise in poultry consumption is mainly due to: its low production cost, its dietary health benefits and its availability of reliable supply of fresh, frozen and roasted products (Mountney, 1976 and CAPMAS, 1990). From the nutritive value point of view, poultry is comparable to beef, lamb and pork in composition and nutritive value. Also, poultry is a good source of iron and B-vitamins (Charley, 1982).

Freezing has been considered one of the most important and successful method of poultry preservation. Most of chicken is sold ready to cook, fresh, frozen or roasted states. Some changes may take place in frozen poultry during frozen storage either in meat or in fat (Khan, 1966; Dhillon and Maurer, 1975; Yamamoto, *et al.*, 1977; Abu-Salem and Khallaf, 1988; Abd El-Rahman, *et al.*, 1989 and Wan, 1991).

Chicken is cooked to produce acceptable colour, flavour, and texture. The cooking method is selected on the basis of the tenderness of the poultry and its fat content, both influenced by the age of the bird. Young tender birds can be cooked by broiling and frying. Some what older but still immature birds suitable for roasting. An oven temperature of  $163^{\circ}\text{C}$  is most often recommended for roasting (Hui, 1996 and O'Brien, 2009).

This investigation was devoted to evaluate the effect of freezing, frozen storage at  $-20^{\circ}\text{C}$  for six months and roasting process on some of fat characteristics, stability and fatty acids composition of the fresh, frozen and roasted chicken.

## 1. MATERIAL AND METHOD

### CHICKEN SAMPLES:

Hubbard chickens were obtained from Bani-Mazar poultry farm (Minia Governorate, Egypt). Chickens were 1350-1450 grams in weight and 7 weeks old (marketable age). Chickens were taken, fasted for 12 hours, slaughtered and allowed to bleed freely for five minutes. The slaughtered chickens were wet-plucked and eviscerated by hand then washed carefully several times with running cold water.

### FREEZING PROCESS:

The edible carcasses of eviscerated and washed chicken were packed into polyethylene bags and kept in deep freezer (Ariston, model CF290) at  $-20^{\circ}\text{C}$  for six months. A monthly samples of three carcasses were taken for analysis. Samples were thawed overnight at  $4^{\circ}\text{C}$  before use in experiments.

### ROASTING PROCESS:

The roasting process was carried out on the thawed chicken of frozen samples at 0, 2, 4 and 6 months of storage at  $-20^{\circ}\text{C}$ . The roasting temperature was about  $325^{\circ}\text{F}$  ( $163^{\circ}\text{C}$ ) as reported by Priestly, 1979; June, 1981 and Hui, 1996). The colour of roasted samples was used to indicate the end point of roasting process. (Weiss, 1970 and Priestley, 1979). The melted fat was collected and kept in brown glass bottles till analysis.

### PREPARATION THE SAMPLE FOR ANALYSIS:

Fresh and processed carcasses samples were prepared for analysis by removing bones manually then passed for three times through a laboratory electric meat mincer model PA-212 (Enleprise MFG Co. USA). Deboned minced flesh of chicken mixed well then packed immediately into tight containers and analysis promptly.

### FAT EXTRACTION:

The fat was extracted by petroleum ether (b.p.  $40-60^{\circ}\text{C}$ ) using a soxhlet apparatus according to I.S.O., 1973 and Lyon, *et al.*, 1988. The miscella was collected, filtered and the solvent was distilled off and the last traces of the solvent were evaporated in a vacuum oven at  $70^{\circ}\text{C}$ . The crude fat was kept in brown glass bottles till analysis.

### FAT ANALYSIS:

The iodine value (I.V.); saponification value (S.V.), free fatty acids (F.F.A.) and peroxide value (P.V.) were determined as described in the A.O.C.S. official methods (1998). The thiobarbituric acid (T.B.A.) value was determined in fat samples by the method of Salih, *et al.* (1986) to measure the oxidative rancidity.

### FATTY ACIDS COMPOSITION:

The methyl esters of the fatty acids and standard samples were prepared as described in A.O.C.S. (1998). The gas liquid chromatographic (GLC) analysis was carried out using a Pye-unicam gas chromatography equipped with a dual flame ionization detector. The coiled glass column in (1.5 n x 4 mm.) was packed with diatomite (100-120 mesh) and coated with 10% polyethylene glycol adipate (PEGA). The column was operated isothermally at  $190^{\circ}\text{C}$ , detector and injection temperature was  $300^{\circ}\text{C}$ . Flow rate was: nitrogen 30 ml/min.; hydrogen 33 ml/min and air 330 ml/min. The presented fatty acids were identified according to an authentic sample of fatty acids chromatographed under the same conditions.

## 2. RESULTS AND DISCUSSIONS

### EFFECT OF FREEZING, FROZEN STORAGE AND ROASTING ON THE DEGREE OF UNSATURATION OF CHICKEN FAT:

Data given in tables (1 and 2) illustrate the change that took place in the degree of unsaturation as shown by change in the iodine value (I.V.) of fat samples either after freezing only or after roasting as well as during frozen storage. It could be noticed that the freezing and roasting processes led to slightly decreased in the (I.V.) in all fat samples. Further decline was observed as the frozen storage period increased. The rate of decrease in I.V. was affected by the initial value before freezing and roasting, by storage period and fat type (either skin or muscle).

The decrease in the I.V. could be attributed to the formation of new fatty acids which differ in their degree of unsaturation or to the distribution of double bonds of the fatty acids during the production of hydroperoxides and intermediate compounds. Such results are in reasonable agreement with those reported by (Swern, 1979; Frankel, *et al.*, 1984 and Iskander, *et al.*, 2010). Other workers (Swern, 1979; June, 1981 and Iskander, 1991) reported that the formation of fatty acids polymers during thermal oxidation of fat or oil will have an effect on decreasing.

In addition, the obtained results revealed that the decrease in the I.V. (tables 1 and 2) was accompanied by the decrease in the values of dienoic, trienoic, polyenoic acids and total unsaturated fatty acids (tables 4 and 5). Such results are in accordance with Khattab, *et al.*, 1974; Eskander and Banu, 1982; Gustone and Norris, 1983; Iskander, 1992 and Hui, 1996).

In addition, the I.V. of the muscle fat samples was little higher than that of skin fat (table 1). This could be attributed to the higher content of unsaturated acids in muscle fat (Gunston and Norris, 1983).

### EFFECT OF FREEZING, FROZEN STORAGE AND ROASTING ON THE SAPONIFICATION VALUE OF CHICKEN FAT:

The changes in the S.V. of Hubbard chicken fat after freezing and roasting at 325°F/163°C as well as frozen storage for six months are shown in tables (1 and 2). Generally, it can be observed from the obtained results that the S.V. increased gradually in all fat samples after freezing and roasting and as frozen storage period increased. The rate of increase in the S.V. was affected by the initial value, storage period and fat type. The highest increase in the S.V. was recorded in skin fat samples and stored for six months (table 1). In contrast, the lowest increase was noticed in muscle fat samples and stored for the same period (198.42).

The increase in S.V. could be attributed to the formation of new fatty acids which have a lower molecular weight, usually due to presence of lower fatty acids. Such results are in general agreement with those reported by Swern, 1979; Gunston and Norris, 1983; Iskander, 1991; Hui, 1996 and Iskander, *et al.*, 2010).

Table 1

**Effect of freezing and storage at -20°C for six months on some chemical characteristics of chicken fat**

Characteristics	Fresh sample		Frozen samples							
			Storage period (months)							
			0*		2		4		6	
	S**	M**	S	M	S	M	S	M	S	M
Iodine value (I.V.) (as g.iodine saturate 100 g. fat sample)	73.00	73.25	72.91	73.05	72.70	72.96	72.25	72.83	72.02	72.50
Saponification value (S.V.) (as mg KOH saponify one g. fat sample)	197.55	196.86	197.64	196.94	197.85	197.15	198.22	197.30	198.63	197.88
Free fatty acids (F.F.A.) (as % oleic acid)	0.32	0.28	0.35	0.31	0.41	0.36	0.48	0.46	0.57	0.53
Peroxide value (P.V.) (as meq. Peroxide/kg. fat sample)	0.65	0.74	0.86	1.03	2.24	2.75	4.87	6.25	8.75	11.44
Tiobarbituric acid value (T.B.A.) (as mg. malonaldehyde/kg.fat sample)	0.74	0.84	0.82	1.07	1.18	1.35	1.87	2.14	2.35	2.51

\* After one day of freezing.

\*\* S = Skin

M = Muscle.

Table 2

**Effect of frozen storage and roasting\* process on some chemical characteristics of chicken fat.**

Characteristics	Before roasting	After roasting				
	Fresh sample (control)	Fresh sample	Frozen samples			
			Storage** period (months)			
			0	2	4	6
Iodine value (I.V.) (as g.iodine saturate 100 g. fat sample)	73.07	72.88	72.69	72.43	72.05	71.82
Saponification value (S.V.) (as mg KOH saponify one g. fat sample)	197.66	197.83	198.15	198.43	198.99	199.25
Free fatty acids (F.F.A.) (as % oleic acid)	0.33	0.39	0.44	0.56	0.67	0.77
Peroxide value (P.V.) (as meq. Peroxide/kg. fat sample)	0.92	1.45	2.67	4.82	8.66	13.45
Tiobarbituric acid value (T.B.A.) (as mg. malonaldehyde/kg. fat sample)	0.81	1.05	1.38	1.74	2.83	3.45

\* The roasting process was carried at 325°F (163°C). The colour of roasted samples was used to indicate the end point of process.

\*\* Storage at -20°C.

#### EFFECT OF FREEZING, FROZEN STORAGE AND ROASTING ON LIPOLYTIC RANCIDITY OF CHICKEN FAT:

The results obtained in tables (1 and 2) showed the development of free fatty acids (F.F.A.) as indicator of lipolytic rancidity of Hubbard chicken fat due to freezing and roasting processes as well as frozen storage at  $-20^{\circ}\text{C}$  for six months. Generally, it could be observed that the F.F.A. content increased slightly and gradually in all fat samples after freezing and roasting processes. Further increase was recorded as storage period increased. The rate of increase in the F.F.A. was dependent on the initial value, the fat type (skin or muscle) and the storage period.

The increase in F.F.A. could be attributed to the hydrolysis of some triglycerides and phosphatides and the liberation of free fatty acids (Edward, 1967 and June 1981). The rate of increase in F.F.A. was higher in fat samples of frozen and roasted chicken than those of frozen samples only (tables 1 and 2) and stored for the same period. This variation could be explained by the accelerating effect of roasting temperature on the hydrolysis of triglycerides and formation of F.F.A. such results are in reasonable agreement with those reported by Alonso, *et al.*, 1977; Iskander, 1991; Kowalski, 1991; Hui, 1996 and Iskander, *et al.*, 2010).

#### EFFECT OF FREEZING, FROZEN STORAGE AND ROASTING ON OXIDATIVE RANCIDITY OF CHICKEN FAT:

Oxidative rancidity is the principal problem in fats and oils. Two determinations: peroxide value (P.V. as indicator of primary oxidation) and thiobarbituric acid (T.B.A. - as indicator of secondary oxidation) are employed in this study to determine the extent of oxidation caused in the chicken fat after freezing, roasting and frozen storage for six months at  $-20^{\circ}\text{C}$ .

Data given in tables (1 and 2) illustrate the changes that took place in peroxide value (P.V.) and thiobarbituric acid due to freezing and roasting processes. Generally, it was noticed that the P.V. increased after freezing and roasting processes. Further increase in the P.V. was recorded as frozen storage period increased. The gradual increase in the P.V. could be attributed to the role of oxygen on oxidation and thermal oxidation and peroxides formation (Khann, 1966; June, 1981 and Tomas, *et al.*, 1990).

The P.V. is related to the peroxides and hydroperoxides (the primary oxidation products) which are unstable under frying or roasting conditions and readily decompose into mixtures of mainly volatile aldehyde compounds (Fritch, 1981 and Melton, *et al.*, 1994).

Concerning the aldehyde development as shown by the thiobarbituric acid (T.B.A.) which is considered as a more reliable indicator of oxidative rancidity (Jacobson, 1967). In general, the results in tables (1 and 2) showed that the T.B.A. value was increased gradually after freezing and roasting. Further increase was recorded as the frozen storage period increased. Pikul and Kummerou (1990) reported that roasting and refrigerated storage increased the amount of malonaldehyde which occurred in muscle.

Results obtained in table (1) also, indicated that the P.V. and T.B.A. values were higher in muscle fat samples than in skin fat samples. These could be explained that muscle fatty tissues (or abdominal fat) of chicken are less stable and highly oxidized than those of skin samples.

#### EFFECT OF FREEZING, FROZEN STORAGE AND ROASTING ON FATTY ACIDS COMPOSITION OF CHICKEN FAT:

The data presented in tables (3, 4 and 5) showed the changes that took place in fatty acids composition of Hubbard chicken fat samples due to freezing, roasting and frozen storage for six months. The results of G.L.C. in tables (3, 4 and 5) showed that the values of  $C_{10:0}$ ,  $C_{12:0}$ ,  $C_{13:0}$ ,  $C_{14:0}$ ,  $C_{15:0}$ ,  $C_{16:0}$ ,  $C_{17:0}$ ,  $C_{18:0}$ ,  $C_{20:0}$ , TS,  $C_{14:1}$ ,  $C_{15:1}$ ,  $C_{16:1}$ ,  $C_{17:1}$ ,  $C_{18:1}$ , total monoenoic fatty acids and ratio of  $C_{18:1}/C_{18:2}$  were increased slightly and gradually either after freezing or after roasting. Other increase was observed as the frozen storage period proceeded in the investigated chicken fat samples.

In contrast, a slight decline was noticed in the value of  $C_{18:2}$ ,  $C_{18:3}$  and  $C_{20:4}$ , TUS and ratio of TUS/TS after freezing and roasting processes. Further, decrease was recorded as the frozen storage period increased. The rate of changes (either decrease or increase) was dependent on the storage periods as well as fat type (skin or muscle).

The decrease in unsaturated fatty acids (especially polyunsaturated fatty acids) could be attributed to the oxidation and thermal oxidation hence, change in the degree of unsaturation.

Also, it is note worthy to mention that the decrease in  $C_{18:2}$ ,  $C_{18:3}$  and  $C_{20:4}$  (tables 4 and 5) was accompanied by the decrease in the I.V. (tables 1 and 2). These results are in accordance with William, 1966, Park, *et al.*, 1990; Hui, 1996 and Iskander, *et al.*, 2010).

### 3. CONCLUSIONS

This work suggests that the chicken must be consumed freshly as soon as possible to avoid the effect of frozen storage and roasting temperature which led to thermal oxidation of chicken fat and formation of harmful substances as malonaldehyde.

Table 3

**Change in saturated fatty acids of chicken fat during storage for six months at -20°C**

Fatty acids (wt.% of total fatty acids)	Fresh sample (Raw)		Frozen samples							
			Storage period (months)							
	S**	M**	0*		2		4		6	
		S	M	S	M	S	M	S	M	
<u>Even no. fatty acids:</u>										
Capric acid - C <sub>10:0</sub>	0.22	0.21	0.22	0.24	0.23	0.26	0.29	0.30	0.34	0.35
Lauric acid - C <sub>12:0</sub>	0.36	0.35	0.36	0.35	0.37	0.38	0.44	0.45	0.48	0.47
Myristic acid - C <sub>14:0</sub>	0.30	0.33	0.31	0.33	0.31	0.35	0.33	0.36	0.37	0.39
Palmitic acid - C <sub>16:0</sub>	24.70	25.28	24.70	25.29	24.71	25.38	24.75	25.43	24.86	25.45
Stearic acid - C <sub>18:0</sub>	5.34	4.81	5.37	4.81	5.38	4.85	5.40	4.99	5.47	5.12
Arahidic acid - C <sub>20:0</sub>	0.18	0.37	0.18	0.37	0.19	0.39	0.24	0.42	0.33	0.45
<u>Sum of even no. acids:</u>	31.10	31.35	31.14	31.39	31.19	31.61	31.45	31.95	31.85	32.23
<u>Odd no. fatty acids:</u>										
Tridecanoic acid - C <sub>13:0</sub>	0.09	0.12	0.10	0.13	0.12	0.17	0.18	0.20	0.24	0.26
Pentadecanoic acid - C <sub>15:0</sub>	0.89	0.72	0.89	0.72	0.90	0.75	0.92	0.82	0.98	0.91
Heptadecanoic acid - C <sub>17:0</sub>	0.26	0.26	0.26	0.27	0.27	0.29	0.32	0.34	0.37	0.39
<u>Sum of odd no. acids:</u>	1.24	1.10	1.25	1.12	1.29	1.21	1.42	1.36	1.59	1.56
Total saturated fatty acids (T.S.)	32.34	32.45	32.39	32.51	32.48	32.82	32.87	33.31	33.44	33.79

\* After one day of freezing.

\*\* S = Skin    M = Muscle.

Table 4

**Change in unsaturated fatty acids of chicken fat during storage for six months at -20°C.**

Fatty acids (wt.% of total fatty acids)	Fresh sample (Raw)		Frozen samples							
			Storage period (months)							
			0*		2		4		6	
	S**	M**	S	M	S	M	S	M	S	M
<b>Monoenoic acids (MEA):</b>										
Myristoleic acid – C <sub>14:1</sub>	0.52	0.58	0.52	0.60	0.53	0.64	0.54	0.68	0.57	0.70
Pentadecenoic acid – C <sub>15:1</sub>	0.23	0.20	0.23	0.21	0.24	0.25	0.25	0.29	0.28	0.32
Palmitoleic acid – C <sub>16:1</sub>	6.21	6.63	6.22	6.65	6.24	6.71	6.26	6.93	6.32	6.98
Heptadecenoic acid – C <sub>17:1</sub>	0.34	0.34	0.35	0.34	0.36	0.35	0.36	0.38	0.37	0.42
Octadecenoic acid – C <sub>18:1</sub>	37.20	35.65	37.21	35.73	37.27	35.81	37.28	35.90	37.32	35.96
Total monoenoic acids (TMEA)	44.50	43.40	44.53	43.52	44.64	43.76	44.69	44.18	44.86	44.38
Dienoic acid – Linoleic – C <sub>18:2</sub>	20.37	21.25	20.31	21.12	20.20	20.71	19.97	20.17	19.60	19.84
Trienoic acid – Linolenic – C <sub>18:3</sub>	2.15	2.18	2.14	2.15	2.08	2.10	1.90	1.88	1.69	1.67
Tetraenoic acid – Arachidonic – C <sub>20:4</sub>	0.64	0.72	0.63	0.70	0.60	0.61	0.57	0.46	0.41	0.32
Total unsaturated acids (TUS)	67.66	67.55	67.61	67.49	67.52	67.18	67.13	66.69	66.56	66.21
C <sub>18:1</sub> / C <sub>18:2</sub> ratio	1.83	1.68	1.83	1.69	1.85	1.73	1.87	1.78	1.90	1.81
TUS / TS ratio***	2.09	2.08	2.09	2.08	2.08	2.05	2.04	2.00	1.99	1.96

\* After one day of freezing.

\*\* S = Skin    M = Muscle.

\*\*\* TS = total saturated fatty acids.

TUS = total unsaturated fatty acids.

Table 5

**Effect of frozen storage and roasting process on fatty acid composition\* of chicken fat**

Fatty acids (wt.% of total fatty acids)	Before roasting	After roasting				
	Fresh sample (control)	Fresh sample	Frozen samples			
			Storage period (months)			
			0	2	4	6
<b>I- Saturated fatty acids:</b>						
<b>Even no. fatty acids:</b>						
Capric acid - C <sub>10:0</sub>	0.21	0.24	0.24	0.27	0.31	0.34
Lauric acid - C <sub>12:0</sub>	0.34	0.36	0.36	0.38	0.40	0.45
Myristic acid - C <sub>14:0</sub>	0.27	0.28	0.29	0.32	0.35	0.37
Palmitic acid - C <sub>16:0</sub>	24.26	24.39	24.51	24.55	24.61	24.73
Stearic acid - C <sub>18:0</sub>	5.21	5.26	5.33	5.37	5.42	5.45
Arahidic acid - C <sub>20:0</sub>	0.18	0.20	0.20	0.23	0.28	0.31
Total of even no. sat. acids	30.47	30.73	30.93	31.12	31.37	31.65
<b>Odd no. fatty acids:</b>						
Tridecanoic acid - C <sub>13:0</sub>	0.10	0.11	0.11	0.12	0.14	0.17
Pentadecanoic acid - C <sub>15:0</sub>	0.75	0.76	0.78	0.80	0.85	0.89
Heptadecanoic acid - C <sub>17:0</sub>	0.24	0.25	0.25	0.27	0.29	0.32
Total of odd no. fatty. acids	1.09	1.12	1.14	1.31	1.28	1.38
Total saturated acids (T.S.)	31.56	31.85	32.07	32.31	32.65	33.03
<b>II- Unsaturated fatty acids:</b>						
<b>Monoenoic acids:</b>						
Myristoleic acid - C <sub>14:1</sub>	0.60	0.60	0.59	0.61	0.61	0.64
Pentadecenoic acid - C <sub>15:1</sub>	0.24	0.24	0.24	0.26	0.28	0.30
Palmitoleci acid - C <sub>16:1</sub>	6.38	6.37	6.37	6.40	6.43	6.47
Heptadecenoic acid - C <sub>17:1</sub>	0.36	0.34	0.34	0.35	0.38	0.41
Octadecenoic acid - C <sub>18:1</sub>	37.47	37.47	37.48	37.51	37.66	37.70
Total monoenoic acids	45.05	45.02	45.02	45.13	45.36	45.52
Dienoic acid - Linoleic - C <sub>18:2</sub>	20.43	20.20	20.07	19.88	19.75	19.58
Trienoic acid - Linolenic - C <sub>18:3</sub>	2.26	2.23	2.18	2.11	1.83	1.60
Tetraenoic acid - Arachidonic - C <sub>20:4</sub>	0.70	0.70	0.66	0.57	0.41	0.27
Total unsaturated acids (T.U.S.)	68.44	68.15	67.93	67.69	67.35	66.97
C <sub>18:1</sub> / C <sub>18:2</sub> ratio	1.83	1.85	1.87	1.89	1.91	1.93
TUS / TS ratio	2.17	2.14	2.12	2.09	2.06	2.03

\* BY G.L.C.

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## ESCHERICHIA COLI O157: H7 IN GOATS

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**Key words:** goats, meat, E. Coli O157:H7, feces

### SUMMARY

Escherichia coli is a normal and necessary part of the intestinal microflora of humans and warm-blooded animals. They cause hemorrhagic colitis and hemolytic uremic syndrome in humans. Ruminants are the main natural host for VTEC and they are usually latent carriers of microorganisms. The aim of our study was to determine the presence of E. Coli O157:H7 in feces goats and swabs taken from goat carcasses. A total of 110 samples of feces were taken: 68 samples from goats reared on the farm and 42 samples from animals reared in the household. At slaughter houses, swabs were taken (in PBS solution) from 20 goat carcasses of which ten were originating from the farm and ten from the household in which cows were also grown.

All samples (faecal samples and swabs) were inoculated on surface chromogenic medium for the selective isolation and presumptive identification of Escherichia coli O157:H7. For the identification of somatic O and H antigen, used a specific antisera. Total of 4 isolates were agglutination with O 157 but only 2 isolates with H7, which is 1,88%. All 4 isolates were originated from faecal samples of goats originating from households. Our study further suggests that this organism can be present in the digestive tracts and feces of goats and may be a potential primary source for E. coli O157: H7 contamination of goat meat and goat meat products from fecal contamination.

Escherichia coli is a normal and necessary part of the intestinal microflora of humans and warm-blooded animals, including fish and reptiles. Only some types can cause diarrhea and a number of additional intestinal diseases. E. coli inhabits gastrointestinal tract of most warm-blooded animals within a few hours or a few days after birth. Various VTEC are present in healthy animals, but in small numbers and these animals are carriers of this bacterium, which is periodically excreted in feces (Meyer-Broseta, 2001).

Escherichia coli O157: H7 is the predominant and most virulent serotype of toxic (VTEC) types, which belong to a subset of enterohaemorrhagic E. coli (EHEC). They are able to produce verotoxin, which has a cytotoxic effect on vero cells. They cause hemorrhagic colitis and hemolytic uremic syndrome in humans, they can bind and cause lesions on epithelial cells, and they have a characteristic large plasmid (Nataro i sar., 1998.) Ruminants are the main natural host for VTEC and they are usually latent carriers of microorganisms.

The presence of VTEC in animal faeces provides them the opportunity to enter the food chain through fecal contamination of milk, contamination of meat with intestinal contents during slaughter or contamination of fruits and vegetables with manure that contains *E. coli*. Most of the outbreaks caused by *E. Coli* O157: H7 are the result of transmission of this bacterium in food of bovine origin. In the event of a transfer of bacterium in food that is not of bovine origin, then cross-contamination with contaminated beef occurred before. Meat is often contaminated during the slaughter process by bovine faeces originating from the intestinal tract of clinically healthy cattle in which there is often a *E. Coli* O157: H7 (Wang et al., 1998).

The aim of our study was to determine the presence of *E.coli* O157: H7 in feces and swabs taken from goat carcasses. Samples were taken from animals reared on the farm and the animals bred in the community with cattle in individual households.

## 1. MATERIAL AND METHOD

A total of 110 samples of feces were taken and 68 samples from goats reared on farms and 42 samples from animals reared in the household. At slaughter, swabs were taken (in PBS solution) from 20 goat carcasses of which ten were originating from the farm and ten from the households cattle was kept.

All samples (faecal samples and swabs) were inoculated on the surface chromogenic medium for the selective isolation and presumptive identification of *Escherichia coli* O157:H7. (chromID™ O157:H7 agar -O157 H7 ID-F, BioMerieux) All plates were incubated at 37°C for 24 h under aerobic conditions and examined for growth after 24 h. If there was no growth, the plates were reincubated and the final assessment was made after 48h.

Suspicious colonies were transferred to individual plate to make pure culture.

For the identification of somatic O antigen by rapid agglutination was carried out with specific antisera Difco™ *E.coli* O antisera O157 and for identification H antigen, antisera Difco™ *E.coli* H antisera H 7 (BD). The applied confirmation test was BBL Crystal E/N ID kit (Becton Dickinson), for the identification serogroup O 157.

Generally, the identification was made with morphology colonies, Gram staining, agglutination with specific antisera and biochemical tests.

## 2. RESULTS AND DISCUSSIONS

After 24 h incubation, suspicious colonies were round, slightly green and 2 mm in diameter. Gram staining showed Gram-negative rods. Total of 4 isolates agglutinated with O 157 but only 2 isolates with H7, which is 1.88%. Strains did not ferment sorbitol and reaction with  $\beta$ -glucuronidase was – negative. Strains are oxidase negative and catalase positive. Indole and MR positive and VP and citrate were negative (Table 1).

Table 1

**Biochemical activity of Escherichia coli O157: H7**

Sahharide	Reaction	Sahharide	Reaction
Sorbitol	-	MR	+
$\beta$ -glucuronidase	-	VP	-
Indole	+	citrate	-

All 4 isolates originating from faecal samples of goats reared on the household. In all other samples has not been detected the presence of strains of E. coli O 157:H7. Our results don't agree completely from the findings of Mobley (2004), because the presence of E. coli O157: H7 was in smaller percentage than that specified by the author. The researcher examined a total of 68 faecal samples from 12 goat herds in North Central Florida and tested them for E. coli O157: H7. Nine of the 12 herds (75%) tested were positive for E. coli O157: H7 and 3 herds (25%) were negative. Thirty of the 68 faecal samples (44%) were positive for E. coli O157: H7. His results of indicated that E. coli O157: H7 was detected in feces from 75% of goat herds tested.

During the hot summer months the percentage of excretion of faeces increases. Johnson et al, (1996) and Sanchez et al, (2002) indicated that in addition to cattle, goats are also carriers of E. coli O157: H7 sheep and pigs, cats, dogs, poultry, horses, rabbits and insects. In addition to these animals, birds and deer can be potential vectors. Research shows that the number of goats positive for E. coli O157: H7 ranged from 14% to 85% (Stephens *et al.*, 2007)

After researchers mainly tested the presence of this pathogen in cattle. Caws are considered to be the main source of E. Coli O157: H7. Pathogen occurs more frequently in calves than in older cattle it is a transient member of normal flora and the prevalence ranges from 1 to 5%. The level of E. coli O157: H7 in cattle faeces ranges from  $<10^2$  CFU/g to  $10^5$  CFU/g. In the same herd more than one strain of E. coli O157: H7 can be isolated from the feces of the same or different animals.

It is expelled through the feces of healthy cattle in the external environment and it survives in bovine feces, depending on temperature and water activity 1 to 3 months or less. However, E. Coli O157: H7 can survive on private households of up to 2 years. The number of cells that will cause illness in cattle is  $10^4$  to  $10^6$  CFU/g after 48 h, and to  $5-10^2$  CFU/g 14 days after achieving the specified number. E. coli O157: H7 is limited to the gastrointestinal tract including the rumen (rumen, reticulum and omasus) and distal parts (distal ileum, proximal cecum, colon).

Survival time of E. coli O157: H7 in the intestinal tract of animals can vary from several days to several years. It depends on many factors such as feed, contaminated drinking water, competitive microbial flora, immune response, age, race, type E. coli, growing conditions of farm animals, population density and season.

Feces or water contaminated with E. Coli O157: H7 can contaminate crops and pastures where the cause can survive for months and be a source of food contamination. In this way, they act as a source of human infection even in the absence of direct contact with animals (Davis i sar, 2003)..

The occurrence of human infection is often associated with improperly cooked and prepared animal products. E. coli O157: H7 remains infectious for a week to a month in food with a lower pH. It doesn't produce toxins in food, but they are produced in the intestines of infected people. The first symptom of inflammation is hemorrhagic colitis (HC), which can progress to hemolytic uremic syndrome (HUS). Toxins produced by EHEC species is called verotoxin, Shiga like toxin or Shiga toxin (Stx). It is believed that these toxins are major virulence factors responsible for the etiopathogenesis of HUS (Karpman et al., 1997).

In 5% of infected people the uremic syndrome is developed, usually a week after the diarrhea, characteristic with hemolytic anemia, thrombocytopenia, destruction of kidneys and death occurs in about 3-5% of infected people (Tarr, 1995). Intense gastrointestinal disease with HC (Hemorrhagic Colitis) may also have adverse effects on the central nervous system, pancreas, lung and heart (Deisingh and Thompson, 2004). The infectious dose for E. coli O157: H7 is from 10 to 100 cells/g (Bell et al., 1994). Incubation period is 3 to 9 days (in humans, four days) after the introduction of bacteria. Thrombotic thrombocytopenic purpura (TTP) usually occurs in older people. Most people eject E. coli O157: H7 after 7 to 9 days, third of children can exude this microorganism for a period of three weeks (Fenwick, 1996).

### 3. CONCLUSIONS

Detection of O157: H7 populations in feces from goat herds in this study suggests that the production and processing of goat meat may carry a significant risk of O157: H7 contamination. This preliminary data indicate that preventive food safety programs would need to be implemented to control food borne illness that may be acquired from the consumption of goat meat products. Programmes should be implemented on farms, in the food production process and the process of food preparation for consumption. By implementing these programmes the risk of infecting people with E. coli O157:H7 will be reduced This research will be expanded to include sampling at more farms and at processing facilities.

#### **Acknowledgements**

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## RESEARCHES CONCERNING PHYSICAL AND CHEMICAL ANALYZES OF SOME BREAD SORTS PROCESSED IN S.C. VEL PITAR S.A.

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**Key words:** bread, chemical analyzes, porosity, acidity, humidity.

### SUMMARY

Nowadays, food stuffs quality and safety are a consumers right with direct effects upon life quality and the problem of these two desiderates is centered upon world and national organisms for consumers interests protection. Because bread and cereal stuffs are one of the most important fields in the food industry, these products are situated at the base of the nutritional pyramid, a study in the bread and other foodstuffs top processing unit represents an idea regarding the achieving of food safety. Bread and cereal stuffs are products which could affect consumer's health in the case of some physical, biological or chemical contamination, after ingestion or during the time by their noxious accumulation into the organisms. Only strict preserving of some processing rules during their processing could assure the quality and safety of these products.

That is why; the present paper proposes itself to carry out some physical and chemical indicators and sensorial asses' ment of two of the bread types obtained in S.C. Vel Pitar S.A. București (Berceni).

### 1. MATERIAL AND METHOD

The present paper studied two of the bread types obtained in S.C. Vel Pitar S.A. București (Berceni), *Graham Bread 300g* and *French Bread 240g*. The analyzes were carried out in the Laboratory of Analyzes in S.C. Vel Pitar S.A. București (Berceni) .

There were sampled 4 batches and there were established sensorial analyzes and physical and chemical ones. The physical chemical analyzes consisted in : acidity, porosity and humidity and the obtained values were compared with the values stipulated by the standards.

The working methods in our researches are the classical ones for physical and chemical parameters used in the production unit S.C. Vel Pitar S.A. and in other control laboratories in our country.

### 2. RESULTS AND DISCUSSIONS

Porosity is a typical feature of bread stuffs which is established having as aim the checking of the processing recipes and technologic process and for the assimilation range of the product. It is done by the volume of the pores, the holes in a total volume of the analyzed sample. In chart number 1 there are presented the average values of porosity in the four analyzed batches of French bread 240 g. There are noticed easy differences regarding the porosity analyze in the four batches, being recorded a mean value of 84,5%. The chart

shows the average values recorded by analyzing the specific protocol for porosity assessment.

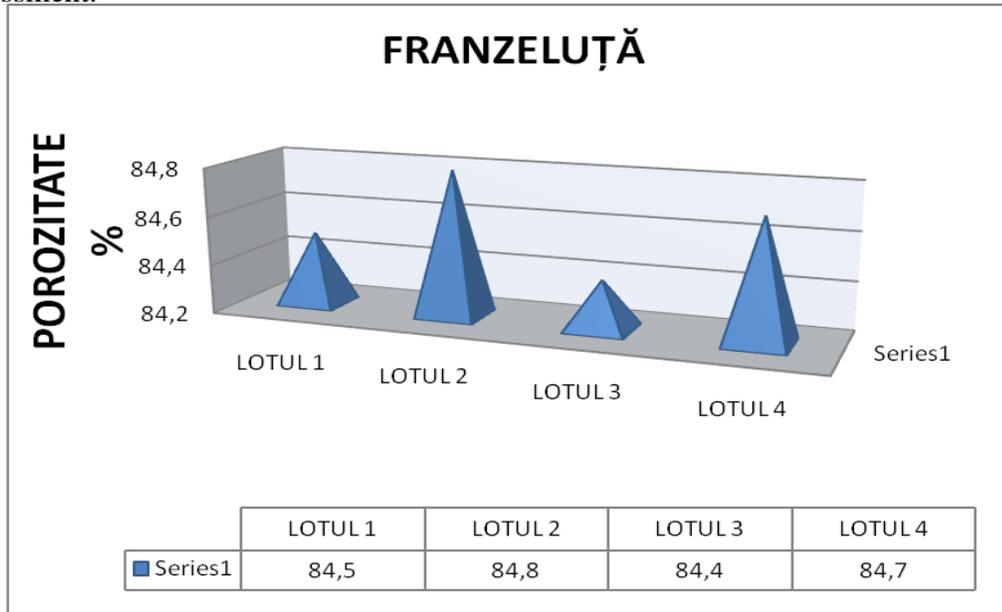


Figure 1. Porosity variation in French bread 240 g

Chart number 2 presents the mean values of porosity recorded in the four batches of Graham 300g. it is noticed that the porosity a recorded few differences between the four batches with a mean of 84,5%. The chart presents the decreases and also increasing of the mean values also framed within the accepted limits by the stipulated standards.

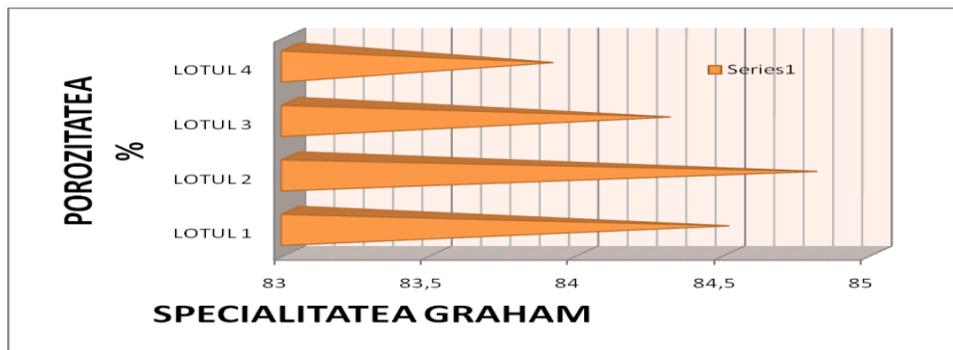


Figure 2. Porosity variation in Graham bread 300 g

The next chemical analyzed parameter is the acidity. There are noticed low differences regarding the acidity analyze in the four batches of French bread, being recorded a mean value of 1,8 acidity degrees/ 100 g product. The chart 3 shows a balance of the mean values variation.

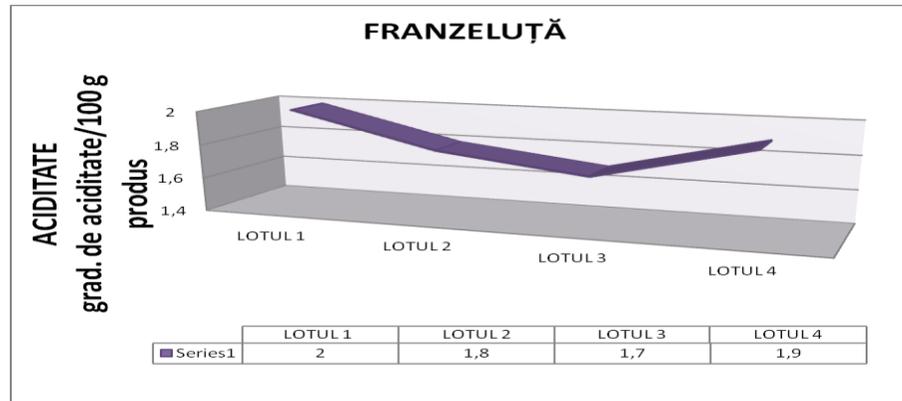


Figure 3. Acidity variation in French bread 240 g

This parameter was also established in Graham bread 300 g. Chart number four emphasize the mean values of acidity in Graham bread 300 g and reveals the mean of 2 acidity degrees/ 100 g product and acceptable limits with very low differences within the four batches.

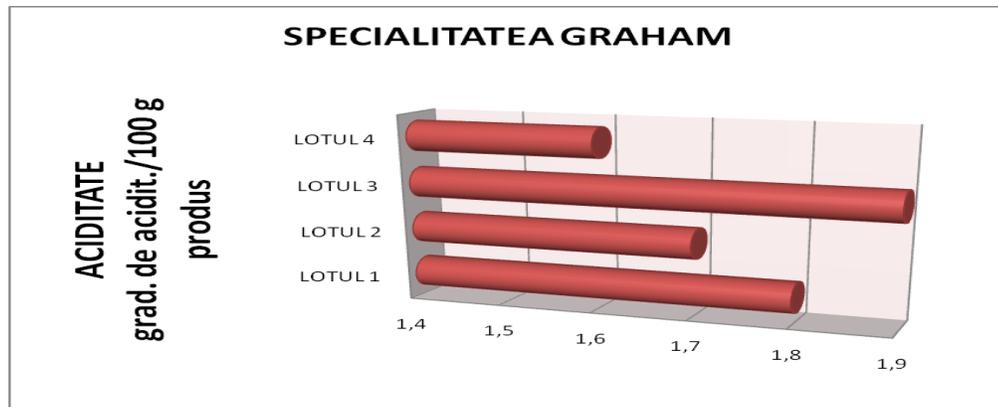


Figure 4. Acidity variation in Graham bread 300 g

The chart number 5 shows the mean values of humidity recorded in the four batches of French bread, analyzed by the specific methods. The mean recorded value was 42,5%. The chart shows the mean values for each batch and emphasize the specific values.

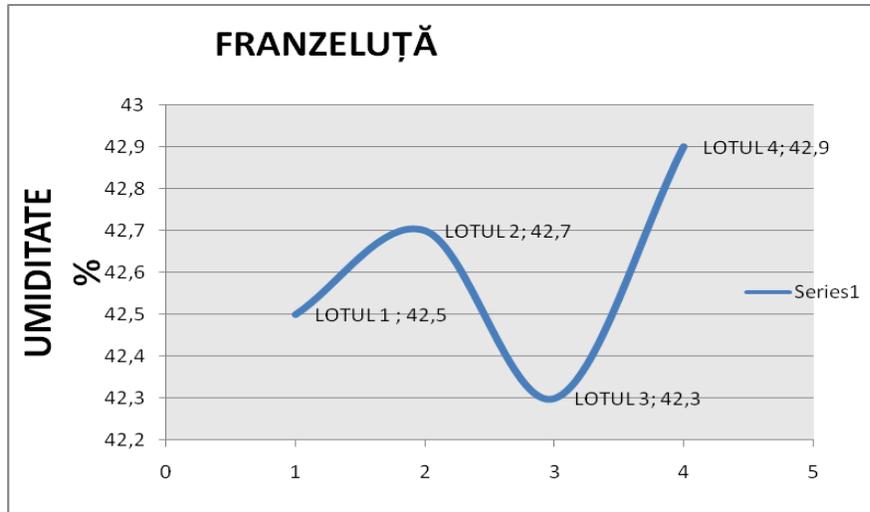


Figure 5. Humidity variation in French bread 300g

Chart number six presented the same parameter recorded in the four batches of Graham bread 300g. It may noticed that the humidity in the four analyzed batches is framed in the acceptable limits with very low variations and presents a mean value of 43%.

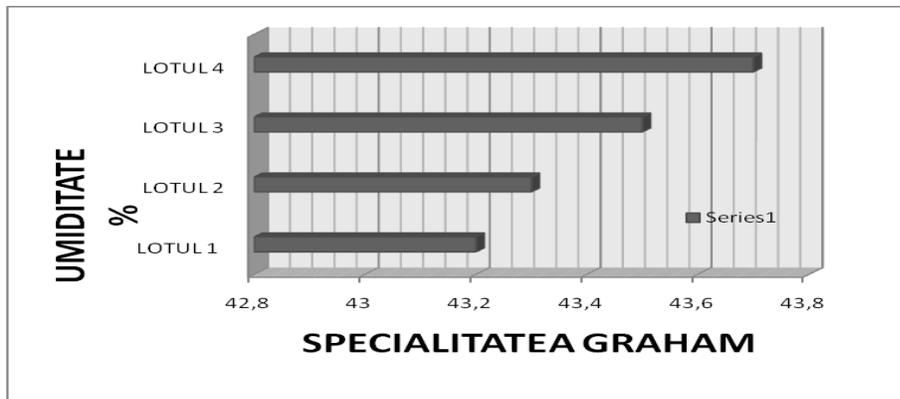


Figure 6 Humidity variation in Graham bread 300 g

### 3. CONCLUSIONS

- The sensorial, examination carried out upon the four batches of French bread 240 g and Graham bread 300g demonstrates that in the analyzed batches bread does not present alterative disorders having the whole normal psycho sensorial quality for the control period.
- From the physical and chemical points of view it is noticed a low variation of the analyzed but with no exceeding of the stipulated limits.
- The analyzed unit proves to be again a top unit in the field, that recommends it to all the consumers.

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## MILK – NATIONAL ISSUE

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**Key words:** procesing capability/milk factories, achieved yield, regions of development, consumption per capita.

### SUMMARY

The paper has as main aim the establishment and scoring of current state regarding the territorial repartition, on developing regions, of investments performed in processing industry/milk factories, as well as their utilization, to establish interest areas for new investments in this field and in downstream and upstream ones. Knowing the number of traders in Romania and production capabilities on product type, milk for consumption, cream, butter, ice-cream, milk and cheese canned and productive potential of regions are very important.

### 1. MATERIAL AND METHOD

The primary data (designed capability of traders, yield achieved in 2010, on main types of products were given by the County Agricultural Offices, respectively of Bucharest one. The data were processed on counties and subsequently on developing regions of Romania. The study was performed on 863 economical agents in milk field. Following their selection, there were established: 156 factories for milk for consumption, 196 for processing acidophilous products, fresh cheese, cream, 61 for butter processing, 96 for ice-cream processing, 1 for milk canned and 356 for fermented cheese processing. After that, the designed capability, yield achieved, its weight of capability designed per county and geographical area were calculated. At the same time, the optimum capacity to ensure milk per capita and the resource potential of geographical area were established.

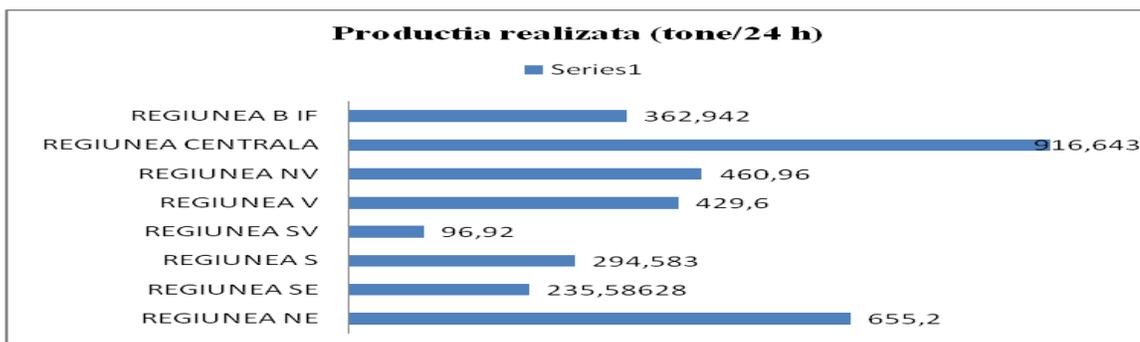
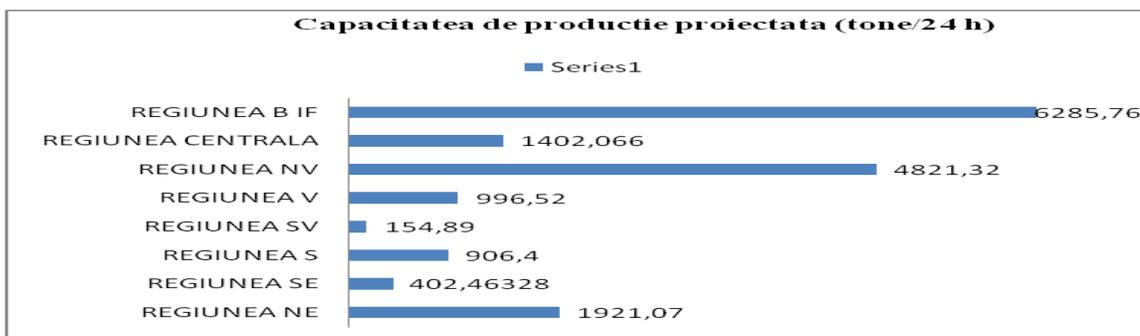
*Table 1*

Milk capability and processing per developing euroregions og Romania											
Nr. crt.	Products		Regions								Total
			NE	SE	S	SV	V	NV	C	IF B	
		Nr. ag	36	28	23	5	12	26	22	4	156
1	Milk for consumption	Designed capability	839,82	279,31	295,87	73,37	82,11	928,05	761,36	578,32	3838,21



5. TECHNOLOGIES OF THE AGROFOOD PRODUCTS PROCESSING

5	Milk canned	Designed capability								0,29		0,29
		Achieved yield								0		0
6	Fermented cheese	No of economical agents	82	81	40	8	14	57	69	2	353	
		Designed capability	69,87	60,02	14,81	2,07	26,46	45,19	65	0,64	284,06	
		Achieved yield	20,24	24,63	4,45	1,53	10,56	10,59	38,64	0,002	110,642	



## 2. RESULTS AND DISCUSSIONS

Analyzing the obtained values, synthesized in Table 1, one can ascertain some aspects very interesting which characterize the current state of milk industry, such as:

A. – at the whole country level, the designed capability is of 16890,49 tons/ 24 h, but it is used only as 20,44%.

- territorial repartition on developing regions, performed investments is extremely ununiform (*fig 1.*), respectively the highest designed capability is registered in region IF B ( 6285, 76 tons/24 h), followed by the North-western region (4821,32 tons/24 h ), while the lowest production capability is registered in South-western region (154,89 tons/24 h).

The study performed at county level emphasizes that there are counties which effectively have no milk processing factories, fact that led to decreasing of designed capability per region level

- on developing regions, the utilization of production capability is:

- central region has registered a production of 916,64 tons/24 h, which represents a weight of 65,68% from designed capability;

- South-western region has ensured a production of 96,92 tons/24 h, which represents a weight of 62,57% from designed capability;

- South-eastern region has ensured a production of 235.54 tons/24 h, which represents a weight of 58,54 from designed capability.

- the lowest production of 362,94 was registered in region IF B, which represents a weight of 5,77 from designed capability.

B. – as regards the repartition of livestock for milk, one can highlight the followinge:

- the northern and central area of Romania, respectively the North-eastern, North-western and central developing regions are characterized by a number of livestock for milk( NE – 314007 individuals, NV – 218036 individuals, C – 188114 individuals), fact that show the highest yields obtained in these areas.

- the lowest number of individuals was registered in South-western developing, where the milk yield have a slight evolution too.

C. – specific consumption per capita, milk and dairy products (equivalent) ensured by the yield previously presented is of 0.16 kg/capita/day, respectively of 58.07 kg/inhabitant/year.

## 3. CONCLUSIONS

The investments in this field were performed without taking into account the potential of livestock rearing in areas;

The synergy between agri-food industry and primary yield represents the vector of economical development;

It is necessary to reassess these investments and to found the mechanisms of developing livestock, especial ruminants;

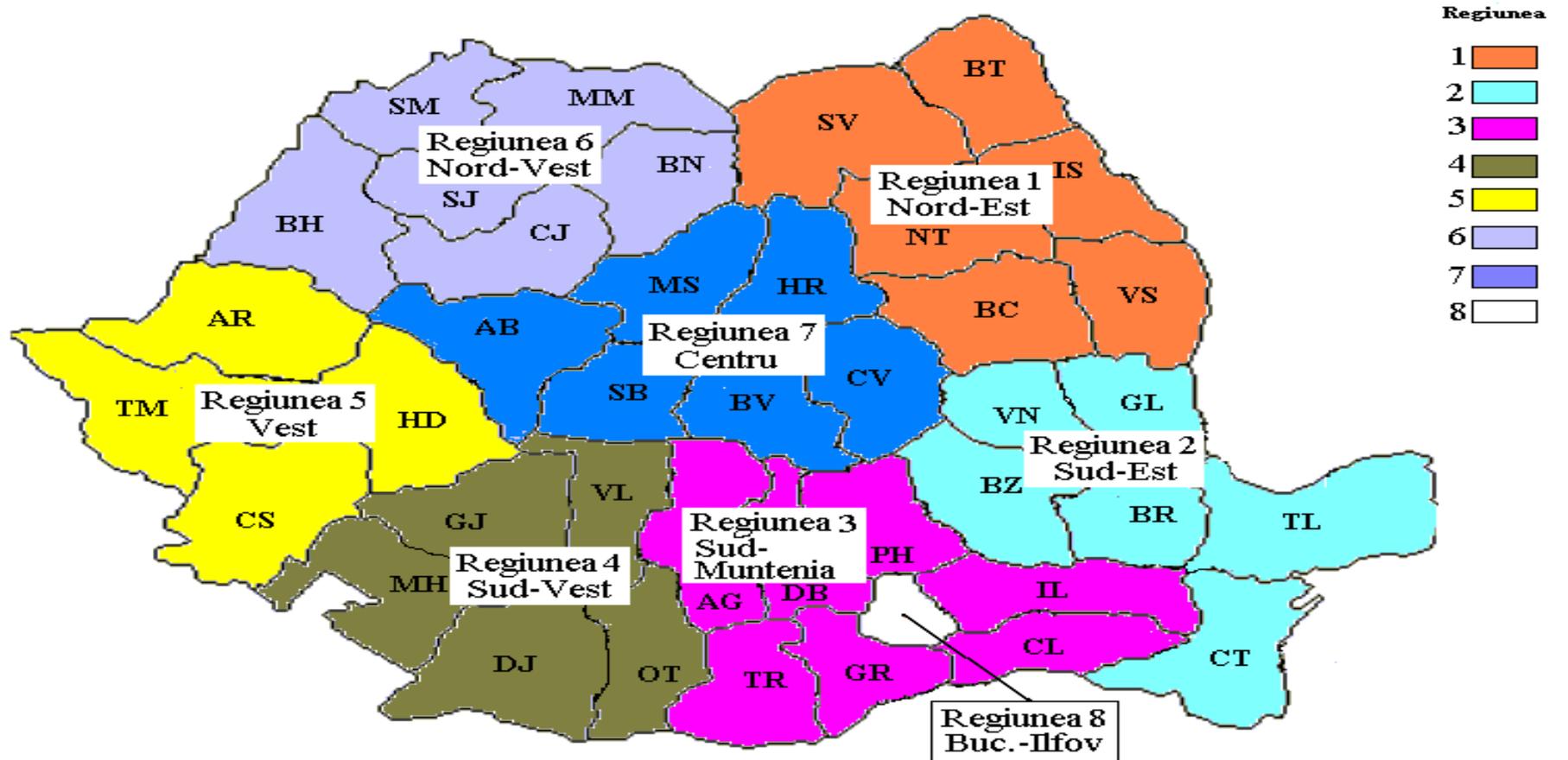
It is necessary to perform future investments in areas which allow them and ensure raw matter;

Financial support to achieve investments for modernizing and restructuring factories of food industry by utilization european funds (National Rural Development Program) and other ones from state budget.

The reinforcement of this industry could be achieved by programs promoted through Ministry of Agriculture and Rural Development, following the increasing of product competitiveness and, on the other hand, releasing new food industry units, supporting stakeholder investment projects.

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## EVALUATION OF OIL AND VEGETABLE FATS SECTOR, ON DEVELOPING REGIONS OF ROMANIA

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**Key words:** designed processing capability, achieved yield, developing regions

### SUMMARY

The paper has as main aim the establishment and scoring of current state regarding the territorial repartition, on developing regions, of investments performed in oil crops processing industry, as well as their utilization, to establish interest areas for new investments in this field and in downstream and upstream ones: farms to cultivate oil crops and their processing units but the establishment of ability to ensure oil consumption per capita.

### 1. MATERIAL AND METHOD

The primary data (designed capability of traders, yield achieved in 2010) were given by the County Agricultural Offices and are available during 1<sup>st</sup> January 2010 – 31<sup>st</sup> December 2010. The data regarding the imports and exports as well as Romanian population were given by the National Institute of Statistics. These data were processed on counties and subsequently on developing regions of Romania.

### 2. RESULTS AND DISCUSSIONS

Based on the obtained results, presented in Table 1, one can highlight the following major aspects, such as:

A – currently, at national level there is a designed capability to process oil seeds of 1492,45 thousands tons, but it is used only as 36.52%, respectively 545,12 thousands tons;

- territorial repartition on developing regions, of performed investments is extremely un-uniform (*fig 1.*), the highest designed capability is of 857,642 thousands tons, in South region, followed by that of 336,69 thousands tons and 136,90 thousands tons, in South-western region and South-eastern one. In the Western and IF-B regions the investments are 0 (zero).

- as regards the yielding capability of economical agents in the field of “oil and vegetable fats”, one can observe (*fig.1*) that the South region has the highest production of 279,71 thousands tons seeds processing, followed by the South-eastern region with a production of 119,38 thousands tons.

- production of oil for consumption (*fig.3*) is directly proportional with the capability to process oil seeds: South region with an oil for consumption production of 111,89 thousands

tons, South-eastern region with an oil production of 47,75 thousands tons, the other regions having an oil production below 30 thousands tons, excepting Western and IF-B regions, where the production is 0 (zero).

According to data presented, the oil consumption/capita is of 10,05 kg.

B – as regards the designed capability to obtain vegetable fats on developing regions, one can ascertain the following:

- the production achieved at the level of whole country is of 3934,57 thousands tons, which represents 6,93 % from the total designed capability.

- on developing regions, the vegetable fat production is:

- IF -B region presents a production of 3888 thousands tons, followed by the South-eastern region with de 29,12 thousands tons, while the North, North-western and Central regions ensure productions belowm 3 thousands tons, excepting Nort-eastern, South-eastern and South regions, which have no investments in this field of activity.

### 3. CONCLUSIONS

1. The designed capability to process oil crop seeds is utilized only as 36,52% proportion, other said, these factories functions below 50% of their designed capability;
2. The designed capability to obtain vegetable fats is exploited in a percentage below 10%, 6.93% more precisely;
3. The investments were performed preponderantly in regions with high cereal potential (South region, South-eastern region and South-western one);
4. According to the above mentioned statistical data (NIS), the designed capability does not cover entirely the need in oil for consumption of Romania.
5. In the case in which, the highest economical agents leave the Romanian market, the designed capability decreases with over 700 thousands tons seed processing. Under these circumstances, the designed capability still under function could ensure the need oil consumption for population as in 2009 was (12,9 kg), only at 100% production capacity;
6. The investments in this field of activity were performed without taking into account the agricultural potential of regions under discussion;
7. The synergy between agri-food industry and primary yield represents the vector of economical development;
8. Oil consumption/capita in 2010 was of 10.05 kg versus 2009 of 12.9 kg.
9. It is recommended, on the future, support for farmers correlated with market requirements and farmer-oriented agricultural consulting ;
10. One can notice that the agricultural and food politics is not a problem just of agriculture and food industry but of whole national economy, too. The passing by of current situation depends on macro-economical politics and sectorial one, evolution of gross weight, productivity of national and sectorial labor, expenses and incomes, which generate increased demand, enlarged market and economical movement.

Table 1

Developing regions	Nr. crt	Oil for consumption				Vegetable fats				
		No of agents	Designed production capability of economical agents	Current production capability of economical agents		Oil production achieved by economical agents	No of agents	Designed production capability	Current production capability of economical agents	
				(thousands tons/year)	(thousands tons/year)				%	(thousands tons/year)
NE Region	1	28	33,92	67,16	198	26,86	0	0	0	0
SE Region	2	30	136,90	119,38	87,2	47,75	1	32,6	29,12	89,32
S Region	3	41	857,64	279,71	32,61	111,89	0	0	0	0
V Region	4	0	0	0	0	0	2	4,6	2,42	52,61
NV Region	5	15	122,86	70,88	57,7	28,35	3	3	2,04	68
SV Region	6	42	336,69	6,49	1,932	2,6	0	0	0	0
C Region	7	5	4,44	1,49	33,56	0,6	2	0,76	0,008	1,05
IF B Region	8	0	0	0	0	0	3	56720,42	3888	6,852
<b>Total country</b>	<b>9</b>	<b>173</b>	<b>1492,45</b>	<b>545,12</b>	<b>36,52</b>	<b>218,05</b>	<b>13</b>	<b>56776,28</b>	<b>3934,57</b>	<b>6.93</b>

Fig. 1

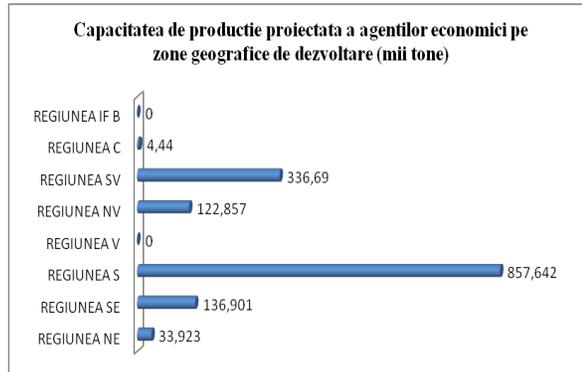


Fig. 2

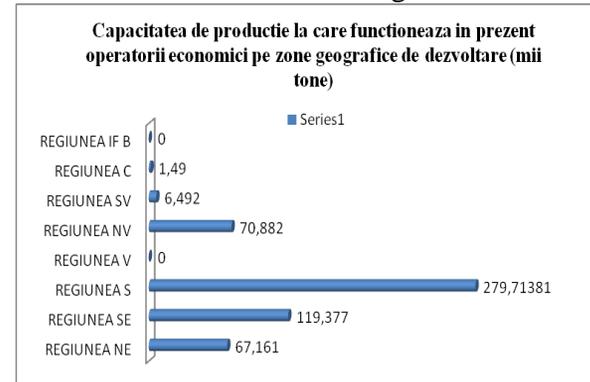


Fig. 3

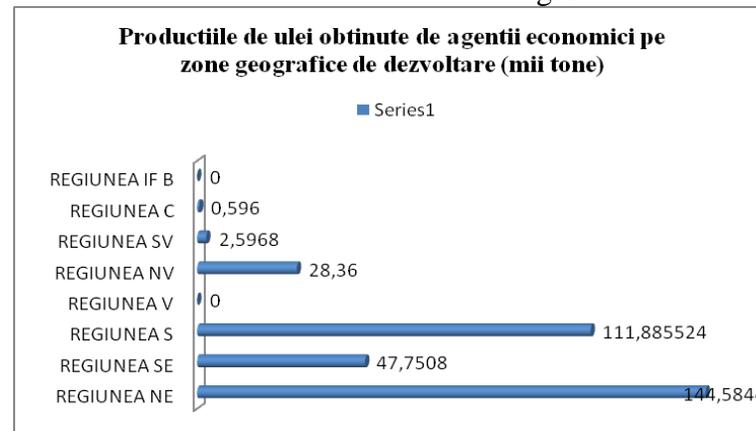


Table 2

Specific oil consumption per capita					
Nr. crt.	Oil production achieved in 2010 (thousands tons)	Import 2010 (thousands tons)	Export 2010 (thousands tons)	Population 2002	Consumption/capita (kg/individual)
1.	218,05	0,018	0,099	21698181	10,05

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